DISTRICT OF SOOKE

WWTP UPGRADE 2020

CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE - 2 2008

STIPULATED PRICE CONTRACT

July 2020

DISTRICT OF SOOKE

WWTP UPGRADE 2020

TABLE OF CONTENTS

The complete Contract Documents consist of the following parts:

1. The Canadian Construction Document's Committee CCDC 2 Stipulated Price Contract - 2008 (Tender Package) consisting of the following parts (**included in this tender package)**:

    - Cover Page
    - Table of Contents
    - Invitation to Tender
    - Instructions to Tenderers
    - Form of Tender
        - Appendix 1 - Schedule of Quantities and Prices
        - Appendix 2 – Preliminary Construction Schedule
        - Appendix 3 - Subcontractors
    - CCDC 2 Stipulated Price Contract
    - Appendix 4 - Safety Covenant
    - Appendix 5 - Prime Contractor Agreement
    - Appendix 6 – Novation Agreement
    - Supplementary General Conditions
    - Specifications
    - Issued for Tender Drawing Set
    - District of Sooke Accepted Bids for Supply of Select Equipment
    - Addendums: TBD

2. District of Sooke: Supply and Delivery of Dewatering Equipment

3. District of Sooke: Supply and Delivery of Screw Conveyors

4. Master Municipal Construction Documents, Platinum, 2009 edition Standard Detail Drawings. These documents are available in the "MMCD - General Conditions, Specifications and Standard Detail Drawings" **(not distributed in this tender package)**.

DISTRICT OF SOOKE

WWTP UPGRADE 2020

The District of Sooke is inviting qualified General Contractors for a Stipulated Price Contract (CCDC2, 2008) for the construction of a centrifuge and process equipment upgrade at the existing Centrifuge Building on West Coast Road, Sooke Wastewater Treatment Plant (WWTP), Sooke, BC.

Work of this Contract involves work within District owned land at the existing WWTP and incorporates the following components:

1. Assume responsibility of Owner Supplied centrifuge, progressive cavity pumps and polymer system via Novation Agreement.
2. Decommissioning of the existing sludge pump system and existing polymer system and associated piping.
3. Assume responsibility of Owner Supplied new conveyor system to convey dewatered sludge cake to new bin location on the exterior of the existing building via free issue.
4. The addition of a new canopy system to house dewatered sludge cake bin.
5. The installation of a new sludge pump system.
6. The installation of a new polymer system.
7. The installation of a new domestic water lines with emergency eye wash/shower and electric hot water tank.
8. The installation, programming and commissioning of instrumentation and controls for the dewatering system, including modifications to the existing system.
9. Modifications to the existing building to accommodate new equipment.
10. Testing, commissioning and switch over to District ownership.

This Tender is available electronically by downloading from BC Bid's Website.

This Tender is scheduled to close at:

Tender Closing Time:	**3:00:00pm Local Time in Sooke**
Tender Closing Date:	**Thursday July 30th, 2020**
Delivered to:	2205 Otter Point Road Sooke, BC V9Z 1J2 **ATTN: Norm McInnis, Chief Administrative Officer**
Tender Enquiries:	Shaun Swarbrick, P.Eng, Stantec Consulting Ltd. Email: shaun.swarbrick@stantec.com Stan Spencer, P.Eng, Stantec Consulting Ltd. Email: stan.spencer@stantec.com

DISTRICT OF SOOKE

WWTP UPGRADE 2020

RECEIPT CONFIRMATION FORM

As receipt of this document, and to directly receive any further information, addendums, etc. regarding this competition, please return this form within two (2) working days to:

ATTN: Norm McInnis
District of Sooke
2205 Otter Point Road
Sooke, BC, V9Z 1J2
Email: NMcInnis@Sooke.ca
Fax: 250.382.0514

Company Name: _____

Address: _____

City: _____

Province/State: _____ Postal/Zip Code: _____

Telephone No: _____ Fax No: _____

Contact Person: _____

Title: _____

Email: _____

Contract: **WWTP UPGRADE 2020**

1 INTRODUCTION

1.1 These Instructions apply to and govern the preparation of tenders for this *Contract*. The District of Sooke is inviting qualified contractors to provide bids on the work detailed herein.

The District of Sooke is inviting qualified General Contractors for a Stipulated Price Contract (CCDC2, 2008) for the construction of a new centrifuge and upgrade of an existing centrifuge at the existing Centrifuge Building on West Coast Road, Sooke Wastewater Treatment Plant (WWTP), Sooke, BC.

1.2 Work of this Contract involves work within District owned land at the existing WWTP. The work of this contract involves the following components:

1.2.1 Assume responsibility of Owner Supplied centrifuge, progressive cavity pumps and polymer system

1.2.2 Decommissioning of the existing sludge pump system and existing polymer system and associated piping.

1.2.3 Assume responsibility of Owner Supplied new conveyor system to convey dewatered sludge cake to new bin location on the exterior of the existing building.

1.2.4 The addition of a new canopy system to house dewatered sludge cake bin.

1.2.5 The installation of a new sludge pump system.

1.2.6 The installation of a new polymer system.

1.2.7 The installation of a new domestic water lines with emergency eye wash/shower and electric hot water tank.

1.2.8 The installation, programming and commissioning of instrumentation and controls for the dewatering system, including modifications to the existing system.

1.2.9 Modifications to the existing building to accommodate new equipment.

1.2.10 Testing, commissioning and switch over to District ownership.

1.3 Direct all tender inquiries regarding the *Contract*, to:
Shaun Swarbrick, P.Eng, Project Manager, Telephone: 250.389-2545
Email: shaun.swarbrick@stantec.com

or

Stan Spencer, P.Eng, Design Engineer, Telephone: 250.589-4087
Email: stan.spencer@stantec.com

1.4 Tenderers must return the enclosed Receipt Confirmation form to receive further information regarding this Invitation to Tender.

1.5 Unless the context requires otherwise, words and expressions not otherwise defined in these Instructions shall have the meaning assigned to them in the Contract, and the following words shall have the following meanings:

"Appendix" means any of the documents listed as such in Article A-3 of the Agreement, and "Appendices" refers to those documents collectively.

"Form of Tender" or "Tender Forms" means the form enclosed with these Instructions, including Appendices attached thereto.

"Instructions" means these Instructions to Tenderers.

"Invitation to Tender" means this Invitation to Tender and all documents enclosed herewith, including the Instructions to Tenderers, the Form of Tender, and the Contract Documents.

"Tender" or "Tender Submission" means a tender submitted in response to this Invitation to Tender.

"Supplementary Specifications" means the supplementary specifications enclosed with these Instructions and listed among the Contract Documents in Article A-3 of the Agreement.

"Tender Closing Time" means the date and time specified in paragraph 3.1 of the Instructions.

2 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 Article A-3 (CCDC, 2008) entitled "Contract Documents". Article A-3 is attached to the Agreement which is included as part of the tender package. The *Contract Documents* include the Drawings entitled "Drawing List".

2.2 A portion of the Contract Documents is included by reference. Copies of these documents have not been included with the tender package. These documents are the relevant sections of the Master Municipal Construction Documents, Platinum, 2009 edition Standard Detail Drawings. These documents are available in the "MMCD - General Conditions, Specifications and Standard Detail Drawings". Refer to Article A-3 attached to the Agreement or, if no edition has been specified, then the applicable edition shall be the most recent edition as of the date of this *Contract*. 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 Article A-3 or the "Drawing List" 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 judgement about its reliability, accuracy or completeness and neither the *Owner* nor any representative of the *Owner* gives any guarantee or representation that the additional information is reliable, accurate or complete.

3 SUBMISSION OF TENDERS

3.1 Tenders must be submitted in a sealed opaque package, clearly marked on the outside with the above Contract Title and Reference No., and must be received on or before:

Tender Closing Time: **3:00 p.m. local time in Sooke**

Tender Closing Date: **July 30th, 2020**

Delivered to: District of Sooke, 2205 Otter Point Road
Sooke, BC V9Z 1J2
ATTN: Norm McInnis, Chief Administrative Officer

3.2 Late tenders will not be accepted or considered and will be returned unopened.

3.3 Tender Submission

3.3.1 Tenders **must** be submitted on the Tender Forms included in these tender documents. The addition to or changing of any words in these Tender Forms by the Tenderer or the failure to comply with and complete all items may be cause for rejection without consideration of the tender.

3.3.2 The Tender Submission **must** include acknowledgement of receipt of all issued addenda.

3.3.3 The Tender Submission **must** include a Bid Bond submitted with the Tender Form, duly completed by a surety licensed to carry on the business of suretyship in British Columbia and having an office in British Columbia, payable to the "District of Sooke", in the amount of ten percent (10%) of the Tender Price.

3.3.4 The Tender Submission **must** include Appendix 1 – the Schedule of Quantities and Prices.

3.3.5 The Tender Submission **must** include Appendix 2 – Preliminary Construction Schedule.

3.3.6 The Tender Submission **must** include Appendix 3 – Subcontractors.

3.3.7 The Tender Submission **must** include Appendix 4 – Safety Covenant.

3.3.8 The Tender Submission **must** include Appendix 5 – Prime Contractor Agreement.

3.3.9 The Tender Submission must include Appendix 6 – Novation Agreement

3.3.10 The Form of Tender **must** bear the signature of a legal signing authority of the Tenderer.

3.3.11 Other than acknowledgement of receipt of addenda, or request for withdrawal or revision, documents submitted as part of a tender will **not** be considered if received by any of the *Owner's* facsimile machines.

3.3.12 Except as expressly and specifically permitted in these Instructions to Tenderers, no Tenderers shall have any claim for any compensation of any kind whatsoever, as a result of participating in the tender, and by submitting a bid, each Tenderer shall be deemed to have agreed that it has no claim.

3.3.13 A Tender Submission must include any items in the Supplementary Specifications that are identified as being due with Tender Submission.

4 ADDITIONAL INSTRUCTIONS TO TENDERERS

4.1 Freedom of Information

The *Owner* is subject to the provisions of the *Freedom of Information and Protection of Privacy Act*. As a result, while Section 21 of the Act does offer some protection for third party business interests, the *Owner* cannot guarantee that any information provided to the *Owner* can be held in confidence. All tenders, after closing time and date become the property of the *Owner*.

4.2 Cost of Tender Submission

The *Owner* shall not under any circumstances be liable for a Tenderer's cost of preparing or submitting a tender.

4.3 Evaluation Criteria

(a) The *Owner* reserves the right to waive informalities in or reject any or all tenders or accept the tender deemed most favorable in the interests of the *Owner*. Tenders will be evaluated on the combination of information provided in the Form of Tender and Appendices, which may offer the best value and not necessarily the lowest price. The *Owner* reserves the right to conduct pre-selection meetings with Tenderers. The *Owner* further reserves the right to conduct post-selection meetings in order to correct, change or adapt the selected Tender to the wishes of the *Owner*. **Acceptance of any tender may be subject to budgetary considerations and/or District of Sooke Council approval, and/or the approval of other jurisdictions having authority.**

4.4 Mandatory Site Meeting

A Mandatory Site Meeting will not be held. to facilitate conditions of item 4.8 and 8.1 below Tenderers can request a site inspection with 48 hours' notice.

Any inquiries, questions, details, information, etc. requested during the site inspection are to be submitted in writing to the individual referred to in paragraph 1.3 of the Instructions to Tenderers. Addendums will be issued as required.

4.5 Addition\Deletion

Tenderers are advised that the Owner may, at its option, and subject to available funding and budgetary considerations, delete any Work described in the Contract Documents or may require that optional work be added to the scope of Work.

4.6 Omissions and Discrepancies

Tenderers must carefully examine the *Contract Documents* and the site of the proposed works, judging for and satisfying themselves as to the probable conditions to be encountered. Should a Tenderer find omissions from or discrepancies in the *Contract Documents*, or be in doubt as to their meaning, the Tenderer should notify the Owner no later than 5 days prior to the tender closing, who may send a written instruction to all Tenderers in the form of an addendum, which shall become part of the contract and shall be covered in the contract price. The Tenderer may not claim, after the submission of a tender, that there was any misunderstanding with respect to the conditions imposed by the documents. No oral interpretations made to a Tenderer as to the meaning of the *Contract Documents* shall be considered binding. Every request for an interpretation shall be made in writing, forwarded to the office referred to in paragraph 3.1 of the Instructions to Tenderers.

4.7 Working Hours

Work at the *Place of Work* shall be carried out only between the hours of 7:00 a.m. and 5:00 p.m. five (5) days a week unless other arrangements are made between the Owner and the Contractor.

4.8 Commencement And Completion of Work

The *Owner* requires that the Work under this Contract be completed as quickly as possible after Contract award, and within the following milestones:

The *Owner* expect to award this work by the beginning of September 2020.

The Contract is required to be substantially complete by November 30th , 2020.

5 TENDER REQUIREMENTS

5.1 The successful Tenderer will, within 10 Days of receipt of the written *Notice of Award* of the Contract, be required to deliver to the Owner the items listed in the Form of Tender paragraph 5.1.1, failing which the provisions of Form of Tender paragraph 6.1 will apply.

6 QUALIFICATIONS, MODIFICATIONS, ALTERNATIVE TENDERS

6.1 Tenders which contain qualifications, or omissions, so as to make comparison with other tenders difficult, may be rejected by the *Owner.*

6.2 A Tenderer may, at the Tenderer's election, submit an alternative tender ("Alternative Tender") which varies the materials, products, designs or equipment from those approved under the *Contract Documents*, or approved by the *Owner* as approved equals as the case may be, but an Alternative Tender must be in addition to, and not in substitution for a tender which conforms to the requirements of the *Contract Documents*.

6.3 The only Alternative Tender that the *Owner* may accept is an Alternative Tender submitted by that Tenderer whose conforming tender, submitted as required by paragraph 6.2 of these Instructions to Tenderers, would have been accepted by the *Owner* in preference to other conforming tenders, if no Alternative Tenders had been invited.

7 APPROVED EQUALS

7.1 Prior to the tender closing time and date, a Tenderer may request the *Owner* to approve materials, products, or equipment “Approved Equal*”* to be included in a tender in substitution for items indicated in the *Contract Documents*

7.2 Applications for an Approved Equal must be in writing, and supported by appropriate supporting information, data, specifications, and documentation.

7.3 If the *Owner* decides in its discretion to accept an Approved Equal, then the *Owner* will issue an addendum to all Tenderers.

7.4 The *Owner* is not obligated to review or accept any application for an Approved Equal.

8 INSPECTION OF THE PLACE OF THE WORK

8.1 All Tenderers, either personally or through a representative, are responsible to examine the *Place of the Work* before submitting a tender. A Tenderer has full responsibility to be familiar with and make allowance in the tender for all conditions at the *Place of the Work* that might affect the tender, including the location of the *Work*, local conditions, topographical soil conditions, weather, and access. Unless otherwise specified in the *Contract Documents*, a Tenderer is not required to do subsurface investigations. By submitting a tender, a Tenderer represents that the Tenderer has examined the *Place of the Work,* or specifically elected not to. No additional payments or time extensions shall be claimable or due because of difficulties relating to conditions at the *Place of the Work* which were reasonably foreseeable by a contractor qualified to undertake the *Work*.

9 INTERPRETATION OF CONTRACT DOCUMENTS

9.1 If a Tenderer is in doubt as to the correct meaning of any provision of the *Contract Documents*, the Tenderer may request clarification from the person named in paragraph 1.3 of the Instructions to Tenderers.

9.2 If a Tenderer discovers any contradictions or inconsistencies in the *Contract Documents* or its provisions, or any discrepancies between a provision of the *Contract Documents* and conditions at the *Place of the Work* as observed in an examination under paragraph 8 of the Instructions to Tenderers the Tenderer shall immediately notify the person named in paragraph 1.3 of the Instructions to Tenderers.

9.3 If the *Owner* considers it necessary, the *Owner* may issue written addenda to provide clarification(s) of the *Contract Documents.*

9.4 No oral interpretation or representations from the *Owner* or any representative of the *Owner* will affect, alter, or amend any provision of the *Contract Documents.*

10 PRICES

10.1 The tendered price will represent the entire cost excluding *Goods and Services Tax (GST)* to the *Owner* of the complete *Work* based on the estimated quantities in the *Schedule of Quantities and Prices* (Appendix 1) of the Form of Tender. Notwithstanding the generalities of the above, Tenderers shall include in the tendered prices (including unit prices, lump sum prices, or other forms of pricing) sufficient amounts to cover:

10.1.1 the costs of all labour, equipment and material included in or required for the *Work,* including all items which, while not specifically listed in the Schedule of Quantities and Prices are included in the *Work* specifically or by necessary inference from the *Contract Documents;*

10.1.2 all assessments payable with respect to labour as required by any statutory scheme such as unemployment insurance, holiday pay,

insurance, CPP and all employee benefits and the Workers Compensation Act;

10.1.3 all overhead costs, including head office and on-site overhead costs and all amounts for the *Contractor's* profit.

10.1.4 The contract is a stipulated price contract.

10.2 The tendered prices and all subcontracts must allow for compliance with all applicable laws regarding trade or other qualifications of employees performing the *Work,* and payment of appropriate wages for labour included in or required for the *Work.*

11 TAXES

11.1 The tendered prices shall cover all taxes and assessments of any kind payable with respect to the *Work but* shall not include *GST. GST* shall be listed as a separate item.

12 AMENDMENT OF TENDERS

12.1 A Tenderer may, without prejudice to itself, withdraw or revise a tender after it has been deposited with the *Owner*, provided the request for withdrawal or revision is filed with the *Owner* in writing before the time set for the Tender closing. Non-facsimile request(s) should be submitted in a sealed opaque envelope clearly marked with the contract name and reference number to the office referred to in paragraph 3.1 of the Instructions to Tenderers. In the case of revision(s), a revised price will not be accepted, only the addition to or deduction from the tender price will be accepted. Written withdrawals or revisions must be signed by the same person or persons who signed the original Form of Tender.

12.2 Any amendment that expressly or by inference discloses the Tenderer's tender price or other material element of the tender such that in the opinion of the *Owner,* the confidentiality of the tender is breached, will invalidate the entire tender.

12.3 **In the case of facsimile requests for withdrawal or revision, they will only be accepted if they are received by the *office referred to in paragraph 3.1 of the Instructions to Tenderers* at least one hour before the scheduled tender closing time. Tenderers assume the entire risk that the facsimile equipment and staff at the referred office will properly receive the facsimile containing the withdrawal or revision.**

13 DURATION OF TENDERS

13.1 After the tender closing time, a tender shall remain valid and irrevocable as set out in paragraph 5.1 of the Form of Tender.

14 QUALIFICATIONS OF TENDERERS

14.1 By submitting a tender, a Tenderer is representing that it has the competence, qualifications and relevant experience required to do the *Work.*

15 AWARD

15.1 The *Owner* reserves the full right, in its sole discretion and according to its own judgement of its best interest to:

15.1.1 Reject any or all tenders;

15.1.2 Waive any defect or deficiency in a tender which does not materially affect the tender or the tender price relative to other tenders and accept that tender;

15.1.3 Accept any tender, including an Alternative Tender which, in accordance with paragraph 6.3 of these Instructions to Tenderers, the *Owner* may accept.

15.2 Tenderers will not be permitted to alter or amend tendered prices included in a tender after the tender closing time. If prior to an award of the *Contract* the *Owner* identifies changes the *Owner* wishes to make to the *Contract Documents,* then such changes shall be dealt with after the award of the *Contract* as changes.

15.3 The *Owner* will notify the successful Tenderer in writing.

16 SUBCONTRACTORS

16.1 The *Owner* reserves the right to object to any of the subcontractors listed in a tender. If the *Owner* objects to a listed subcontractor(s) then the *Owner* will permit a Tenderer to, within *5* days, propose a substitute subcontractor(s) acceptable to the *Owner* provided that there is no resulting adjustment in the tender price or the completion date set out in paragraph 2.2 of the Form of Tender. A Tenderer will not be required to make such a substitution and, if the *Owner* objects to a listed *Subcontractor{s),* the Tenderer may, rather than propose a substitute subcontractor(s), consider its tender rejected by the *Owner* and by written notice withdraw its tender. The *Owner* shall, in that event, return the Tenderer's bid security.

17 OPTIONAL *WORK*

17.1 If the Schedule of Quantities and Prices includes any tender prices for Optional *Work,* then Tenderers must complete all the unit prices for such Optional *Work.* Such tender prices shall not include any general overhead costs, or other costs, or profit, not directly related to the Optional *Work.*

17.2 Notwithstanding that the *Owner* may elect not to proceed with the Optional *Work,* the tender prices for any Optional *Work,* including the extended totals for Optional *Work* unit prices, shall be included in the tender price for the purpose of any price comparisons between tenders.

Contract: DISTRICT OF SOOKE WWTP UPGRADE 2020

TO OWNER:

1 I (WE), THE UNDERSIGNED:

1.1 have received and carefully reviewed all of the *Contract Documents*, including the Instructions to Tenderers and the following Addenda:

_____

_____

_____

_____

_____

(ADDENDA, IF ANY) (TENDERER TO COMPLETE)

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

2 ACCORDINGLY, I (WE) HEREBY OFFER:

2.1 to perform and complete all of the *Work* and to provide all the labour, equipment and material 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 November 30th, 2020 subject to receipt of a *Notice to Proceed* being issued on or before August 24th, 2020 and

2.3 to do the *Work* for the Stipulated price, which is the sum of the products of the actual quantities incorporated into the *Work* and the appropriate Lump Sums 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*.

3 I (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.

4 I (WE) CONFIRM:

4.1 that the following Appendices are attached to and form a part of this tender:

4.1.1 Appendix 1 – Schedule of Quantities and Prices

4.1.2 Appendix 2 – Preliminary Construction Schedule

4.1.3 Appendix 3 – Subcontractors

4.1.4 Appendix 4 – Safety Covenant

4.1.5 Appendix 5 – Prime Contractor Agreement

4.1.6 Appendix 6 – Novation Agreement; and

4.1.7 the **Bid Bond** as required by paragraph 3.3.3 of the Instructions to Tenderers.

5 I (WE) AGREE:

5.1 that this tender will be irrevocable and open for acceptance by the *Owner* for a period of 60 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 10 working days of receipt of the written *Notice of Award* deliver to the *Owner*:

a. Performance Bond and a Labour and Material Payment Bond, each in the amount of 50% of the *Contract Price* 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*; and

b. a Construction Schedule, as provided by GC 3.5.1; and

c. a "clearance letter" indicating that the tenderer is in WorkSafe BC compliance; and

d. a copy of the insurance policies as specified in Supplementary General Condition 11.1 indicating that all such insurance coverage is in place; and

e. a Health and Safety Program Manual pertaining to the Work; and

5.1.2 the Owner shall issue a notice to proceed with the *Work* (the “Notice to Proceed”) within 14 working days of receipt of the documentation required under item 5.1.1 above.

5.1.3 within 2 working 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*.

5.1.4 sign the *Contract Documents* within five (5) working days after receiving them and forward them to the *Owner* for signing.

5.1.5 within 10 days of the issue of the *Substantial Performance of the Work* deliver to the *Owner*, a Maintenance Period Financial Security as per Supplementary General Condition 11.2.3.

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

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

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

7 I (WE) DECLARE THAT:

7.1 no person, firm, or company other than the undersigned, has any interest in this tender or in the proposed *Contract* for which this tender is made;

7.2 this tender is made without any connection, knowledge, comparison of figures, or agreement with any other company, firm or person making a tender for the same work;

7.3 in tendering for this work, and when called upon to enter into an agreement with the *Owner*, I (we) will be bound to comply with all laws, statutes, and municipal bylaws pertaining to the work. The agreement will be governed by the laws of the province of British Columbia;

7.4 in submitting this tender I (we) did not rely upon any information provided by the *Owner*, or any of the *Owner's* employees or agents, relating to the conditions, contingencies, risks or other circumstances, local or otherwise, which might influence or affect the performance or the cost of the work, including, without limiting the nature of the ground, subsoil, substrata of the work site, the means of access to the work site, the quality, quantity, nature or location of the materials to be furnished or removed in performance of the work, and the conditions under which the labour force will be employed, except the extent that any such information is expressly set forth in the *Contract Documents*. I (we) have relied on our own examination of the work site and have informed ourselves as to all conditions, contingencies, risks, and circumstances, local or otherwise, which might influence or affect the performance or the cost of the work. I (we) accept the site prior to the signing of the *Contract*.

8 WE AGREE:

8.1 The *Work* shall be completed entirely within two (2) months of achieving Substantial Performance (the "Designated Completion Period");

8.2 There shall be no extension of time for completion of the *Work* beyond the Designated Completion Period for any reason OTHER than delays clearly attributable to the OWNER, its agents, employees, or authorized representatives.

9 I (WE) DECLARE THAT:

9.1 I (we) recognize that the lowest or any tender will not necessarily be accepted; and

9.2 I (we) recognize that the *Owner* reserves the right to reject all tenders or to accept the tender which best suits its long term objectives; and

9.3 I (we) recognize that the *Owner* reserves the right to accept or reject all or part of this Tender at any time during the period specified by paragraph 5.1 of this Form of Tender.

10 I (WE) DECLARE THAT:

10.1 I (we) do not (or any related company) have any family, ownership, and operating relationships with the District of Sooke, or any elected official, staff or other officials holding public office in the District of Sooke and agree that the Owner reserves the right to reject any tender that may be perceived to be in a conflict of interest.

11 I (WE) DECLARE THAT:

11.1 In this tender:

(a) "Related Party of the Tenderer" means:

- an officer or director of the Tenderer;
- a shareholder of the Tenderer;
- a corporation with a shareholder or director who is also a shareholder or director of Tenderer;

(b) "Public Authority" has the same meaning as under the Community Charter.

11.2 I (we) hereby declare that neither the Tenderer nor a Related Party of the Tenderer:

(a) has had a bid bond or performance bond retained or claimed against;
(b) has breached a contract for works or services with the *Owner* or other Public Authority in British Columbia;
(c) has been engaged in a legal action against the *Owner* or another Public Authority in British Columbia, or the elected or appointed officers and employees of the *Owner* or that other Public Authority, in relation to;

- any other contract for works or services;
- any matter arising from the exercise of the Owner's or the other Public Authority's powers, duties or functions under the Community Charter, Local Government Act, or other enactment;

(d) has been charged or convicted of an offence in relation to the performance of a contract for works or services with the Owner or other Public Authority;

within five years of the closing date of this Tender.

Tenderers who are unable to truthfully complete this declaration must provide full particulars of the relevant circumstances.

Submission of a false declaration is grounds for rejection of a tender.

11.3 I (we) hereby declare that the *Owner* may in its absolute discretion reject a Tender submitted by a Tenderer if the Tenderer or a Related Party of the Tenderer:

(a) has had a bid bond or performance bond retained or claimed against;
(b) has breached a contract for work or services with the *Owner* or other Public Authority in British Columbia;
(c) has been engaged in a legal action against the Owner or another public authority in British Columbia, or the elected or appointed officers and employees of the Owner or that other public authority, in relation to:

- any other contract for works or services;
- any matter arising from the exercise of the Owner's or the other public authority's powers, duties or functions under the Community Charter, Local Government Act, or other enactment;

(d) has been charged or convicted of an offence in relation to the performance of a contract for works or services with the *Owner* or other Public Authority;

within five years of the closing date of this Tender.

11.4 I (we) hereby declare that in determining whether to reject a tender the *Owner* will consider whether:

(a) the legal action is likely to affect the Tenderers ability to work with the Owner, its consultants, and representatives, and;

whether the *Owner's* or other public authority's experience with the Tenderer indicates that the *Owner* is likely to incur increased costs including but not limited to staff and legal costs in the administration of this contract if it is awarded to the Tenderer.

12 I (WE) AGREE THAT:

12.1 I (we) agree that if any director, officer or employee, agent or other representative of a Tenderer makes any representation or solicitation to the Mayor, any Councillor, officer or employee of the District of Sooke, other than those specifically designated in the Tender documents, with respect to this Tender, whether before or after the submission of the Tender, the District shall be entitled to reject or not accept the Tender.

MY (OUR) ADDRESS is as follows:

_____
(Full Legal Name of Corporation, Partnership, Joint Venture or Individual)

_____

_____

(Address)

Phone:_____

Fax:_____

E-mail:_____

This Tender is executed this_____ day of_____, 2017.

_____
(Printed Name)

_____
(Authorized Signatory)

NOVATION AGREEMENT ACKNOWLEDGEMENT

The Tender agrees to join in an assignment and Novation Agreement in the form set out in Appendix A as soon as the construction contract between the District and the General Contractor has been signed.

EXECUTION BY TENDERER

This Tender is executed at_____this_____day of_____, 2019.

Print name of District or District, and Province, or if outside Canada, Country.

SIGNED

by _____
(Print Company Name)
By its authorized signatory (ies):

_____
(Signature)

_____
(Print Name and Title)

END OF SECTION

Appendix 1

SCHEDULE OF QUANTITIES AND PRICES – GST EXCLUDED
(See paragraphs 3.3.4 and 10.1 of the Instructions to Tenderers)

Description	Quantity	Unit	Total Price ($)
DIVISION 00 – CONTRACT REQUIREMENTS			
Item 1.1 – Bonding and Insurance	1	LS	
DIVISION 01 – GENERAL REQUIREMENTS			
Item 2.1 – Mobilization and Demobilization	1	LS	
Item 2.2 – Startup, Commissioning and Training	1	LS	
Item 2.3 –O and M Manuals and Record Drawings	1	LS	
DIVISION 03 - CONCRETE	1	LS	
DIVISION 05 - METALS	1	LS	
DIVISION 22 - PLUMBING	1	LS	
DIVISION 25 – INTEGRATED AUTOMATION			
Item 6.1 – SCADA PLC Programming/Integration	1	LS	
DIVISION 26 – ELECTRICAL			
Item 7.1 – Electrical Equipment and Wiring	1	LS	
Item 7.2 – Commissioning Support	1	LS	
Item 7.3 – Other Electrical	1	LS	
DIVISION 40 – PROCESS EQUIPMENT			
Item 8.1 – Process Piping and Valves	1	LS	
Item 8.2 – Other Process Appurtenances	1	LS	
DIVISION 43 – PROCESS PUMPS			
Item 9.1 – Dewatering Centrifuge Feed Pumps	1	LS	
DIVISION 46 – DEWATERING EQUIPMENT			
Item 10.1 – Dewatering Centrifuge	1	LS	
Item 10.2 – Polymer System	1	LS	
Item 10.3 – Conveyor System	1	LS	

Description	Quantity	Unit	Total Price ($)
		Sub-Total:	**$**
		GST (5%):	**$**
		Total:	**$**

Appendix 2

PRELIMINARY CONSTRUCTION SCHEDULE

(See paragraph 3.3.5 of the Instructions to Tenderers)

Indicate Time-Scaled Network Construction Schedule Based on *Critical Path Method*.

ACTIVITY	MILESTONE DATES	CONSTRUCTION SCHEDULE WITH CRITICAL PATH SHOWN (Weeks)												
		1	2	3	4	5	6	7	8	9	10	11	12	13

Tenderer's Initial	Owner's Initial

Appendix 3

SUBCONTRACTORS

(See paragraphs 3.3.6 and 16.2 of the Instructions to Tenderers)

TENDER ITEM	TRADE	SUBCONTRACTOR NAME	PHONE NUMBER

Appendix 4

SAFETY COVENANT

BETWEEN:

_____of
(Company Name (Print legibly)

_____
(Address)

_____
(City) (Postal Code)

_____
(Phone no.) (Fax no.)

hereinafter referred to as the "Contractor"

AND: **DISTRICT OF SOOKE**

hereinafter called the "Owner"

WHEREAS:

The Contractor covenants and agrees that when performing any work for the Owner, whether directly as a contractor or indirectly as a sub-contractor, it will adhere to all of the requirements of the Occupational Health and Safety (OHS) Regulation, B.C. Reg. 296/97, as may be amended from time to time, that are applicable to the work being performed, and as well will comply with the provisions of the *Workers Compensation Act, R.S.B.C, 1996, c.492*, as amended (the 'Act').

Without limiting the generality of the foregoing, the Contractor agrees:

1) Before commencing any work for the Owner, the Contractor will consult the OHS Regulation and will determine which provisions of the OHS Regulation is applicable to the work that the Contractor is to perform. The Contractor will strictly comply with all applicable OHS Regulations when performing the work.

2) Before commencing any work for the Owner, the Contractor will review and familiarize itself with any existing policies or procedures developed by the Owner in relation to the work. If in the opinion of the Contractor, by following a policy or procedure that the Owner has established in relation to the work, the Contractor, or an employee of the Contractor or of the Owner, or any other worker, is put at increased risk, the Contractor must request a written change of policy or procedure from the Owner, applicable only to the work the Contractor is to perform, before proceeding with the work. The Owner reserves the right to refuse to amend its policies or procedures in response to any such request where the Owner, after such consultation with WorkSafe BC as the Owner considers necessary, determines that the Owner's policy or procedure does not increase the risk to any worker at the location of the work to be performed, and determines that the Contractor's request is unreasonable, or is unnecessary for the protection of workers at the location of the work.

3) To have read every section of the OHS Regulation that pertains to the job at hand, to ensure that it understands the pertinent OHS Regulation and its application to the supervisor(s) and to all of the workers at the location of the work, and to ensure that each worker under the Contractor's supervision follows the applicable OHS Regulation. To assist Contractors with this task, the District of Sooke directs them to consult with WorkSafe BC directly, to access the WorkSafe BC Regulations and Policies available on the WorkSafe BC website.

4) To understand, comply with and, to the full extent of the Contractor's lawful authority, to enforce all of the following provisions of the OHS Regulation as they pertains to the job at hand and to the workers employed by the Contractor, and to provide to the owner, at any time upon request, evidence of compliance with the following:

a) Rights & Responsibilities – Occupational Health & Safety Program (Part 3, including investigations, inspections, written instructions, records and statistics, adequate supervision, complete understanding by the workforce of the right and responsibility to refuse unsafe work)
b) General Conditions (Regulation – Part 4)
c) Chemical and Biological Substances (Regulation – Part 5)
d) Substance Specific requirements (Regulation – Part 6)
e) Noise, Vibration, Radiation and Temperature (Regulation – Part 7)
f) Personal Protective Clothing and Equipment (Regulation - Part 8)
g) Confined Space Entry (Regulation – Part 9)
h) Lock-out (Regulation – Part 10)
i) Fall Protection (Regulation – Part 11)
j) Tools, Machinery and Equipment (Regulation – Part 12)
k) Ladders, Scaffolds and Temporary Work Platforms (Regulation – Part 13)
l) Cranes and Hoists (Regulation – Part 14)
m) Rigging (Regulation – Part 15)
n) Mobile Equipment (Regulation – Part 16)
o) Traffic Control (Regulation – Part 18)
p) Electrical Safety (Regulation – Part 19)
q) Construction, Excavation & Demolition (Regulation – Part 20)
r) Forestry Operations (Regulation – Part 26)
s) Evacuation and Rescue (Regulation – Part 32)
t) Occupational First Aid (Regulation – Part 33)
u) Coordination of Multiple Employer Workplaces (Regulation – Part 20, s. 20.3)

PROVISIONS OF THE *WORKERS COMPENSATION ACT* – PART 3 SPECIFIC TO CONTRACTORS ON A WORKSITE:

i. Division 3 – General duties of Employers, Workers and Others (Sections 115, 116, 117, 118, 119, 120, 121, 122, 123, 124);
ii. Division 4;
iii. Division 10.

5) The *Workers Compensation Act* stipulates that the Owner (the District of Sooke) is required to enforce any observed infraction of the Act or Regulation. The Contractor accepts that the District of Sooke will be conducting periodic checks of the Contractor during the Contractor's work for the District of Sooke and will be asking the Contractor to comply with the Act/Regulation in the event that any contravention is observed. If a contravention is observed and not corrected, the Contractor may be asked to leave the worksite and may result in termination of the contract for the work.

6) For the purposes of streamlining large construction projects and multiple employer worksites, the Owner reserves the right to designate a "prime contractor" amongst contractors who are working on a job-site together. A designated person employed by the "prime contractor" – appointed by the Owner - will act as the coordinator of the other contractors on that job-site and will ensure that each of the contractors on the job site are following all of the Act and WorkSafe BC Regulations as well as site-specific policies and procedures. This includes having in place an approved WorkSafe BC Safety Program and a list of the

qualified persons amongst the other contractors who have been designated to be responsible for each of the other contractor's site health and safety activities.

7) In the event that a prime contractor has been designated, it is the responsibility of the Contractor to inquire who the "prime contractor" is for the worksite and to comply with the requirements for a multiple employer worksite where a prime contractor has been designated, as set out in the preceding section.

NOTE:

a) Payment of WorkSafe BC Assessments by any Contractor does not obviate the responsibility of the contractor to any of the foregoing.

b) The foregoing constitutes requirements of the Prevention Division of WorkSafe BC for any workplace in the Province of British Columbia and constitutes the Owner's expectations of contractors.

The Contractor covenants and agrees that when performing any work for the Owner, whether directly as a contractor or indirectly as a sub-contractor, it will adhere to all of the requirements of the B.C. Employment Standards Act (RSBC 1996), as may be amended from time to time, that are applicable to the work being performed, including but not limited to:

1) Section 36 (2); an employer must ensure that each employee has at least 8 consecutive hours free from work between each shift worked.

2) Section 39; despite any provision of this Part, an employer must not require or directly or indirectly allow an employee to work excessive hours or hours detrimental to the employee's health or safety.

THIS Covenant made the_____day of_____, 2020, in

_____in the Province of British Columbia.
(City)

CONTRACTOR:

_____
Company Name

_____
Authorized Signatory

_____
(Printed name)

Appendix 5

PRIME CONTRACTOR AGREEMENT

1. The Contractor shall, for the purposes of the Workers Compensation Act, and for the duration of the Work of this Contract:

   .1 be the "prime contractor" for the "Work site", and

   .2 do everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with the Act and its regulations, as required to ensure the health and safety of all persons at the "Work site".

.2 The Contractor shall direct all Subcontractors, Sub-subcontractors, Other Contractors, Employers, Workers and any other persons at the "Work site" on safety related matters, to the extent required to fulfill its "prime contractor" responsibilities pursuant to the Act, regardless of:

   .1 whether or not any contractual relationship exists between the Contractor and any of these entities, and

   .2 whether or not such entities have been specifically identified in this Contract.

As per the requirements of the Workers Compensation Act Part 3, Division 3, Section 118(1-3) which states:

Coordination of multiple-employer Workplaces

118(1) In this section:

"multiple-employer Workplace" means a Workplace where Workers of 2 or more employers are Working at the same time;

"prime contractor" means, in relation to a multiple-employer Workplace,

(a) the directing contractor, employer or other person who enters into a written agreement with the owner of that Workplace to be the prime contractor for the purposes of this Part, or

(b) if there is no agreement referred to in paragraph (a), the owner of the Workplace.

(2) The prime contractor of a multiple-employer Workplace must

(a) ensure that the activities of employers, Workers and other persons at the Workplace relating to occupational health and safety are coordinated, and

(b) do everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with this Part and the regulation in respect to the Workplace.

(3) Each employer of Workers at a multiple-employer Workplace must give to the prime contractor the name of the person the employer has designated to supervise the employer's Workers at that Workplace.

The Contractor covenants and agrees that when performing any work for the Owner, whether directly as a contractor or indirectly as a sub-contractor, it will adhere to all of the requirements of the B.C.

Employment Standards Act (RSBC 1996), as may be amended from time to time, that are applicable to the work being performed, including but not limited to:

3) Section 36 (2); an employer must ensure that each employee has at least 8 consecutive hours free from work between each shift worked.

4) Section 39; despite any provision of this Part, an employer must not require or directly or indirectly allow an employee to work excessive hours or hours detrimental to the employee's health or safety.

I fully understand and accept the responsibilities of the prime contractor designation in accordance with the Workers Compensation Act and the B.C. Employment Standards Act while contracted by the *District* on ***project location:*** _____ and will abide by all Workers Compensation Board Regulation requirements.

Date: _____

Project: _____

Company Name: _____

Authorized Signatory: _____

Printed Name: _____

Witness Signatory: _____

Printed Name: _____

Appendix 6
NOVATION AGREEMENT

BETWEEN: **DISTRICT OF SOOKE**
(DISTRICT)

AND: _____
CONTRACTOR)

AND: **ALFA LAVAL INC.**
(SUPPLY CONTRACTOR)

WHEREAS:

A. District entered into a Contract with the Supply Contractor dated [___], for the Supply and Delivery of Dewatering Equipment (Supply Contract), which is annexed hereto as Appendix "A";

B. It is a requirement of the Supply Contract that the Supply Contractor enter into a Novation Agreement with the General Contractor (hereby referred to as “the contractor”) selected by the District for the Construction Contract;

C. District entered into a contract with Contractor dated [____], for [_____] (Construction Contract);

D. It is a requirement of the Construction Contract that the Contractor enter into a Novation Agreement with Supply Contractor so that Supply Contractor becomes a subcontractor to the Contractor;

E. NOW THEREFORE in consideration of the premises and of the mutual agreements hereinafter contained the parties agree as follows;

1 The Contractor and Supply Contractor agree to be bound by the terms of the Supply Contract, annexed hereto as Appendix "7", with the Contractor assuming all the rights and obligations of the District as set out therein.

2 Supply Contractor retains all the rights and obligations set out in the Supply Contract and henceforth accepts the Contractor in place of the District.

3 Supply Contractor agrees that henceforth it is a subcontractor to the Contractor in respect of the Construction Contract.

4 Supply Contractor hereby releases the District from all of the District's obligations under the Supply Contract and from all claims of every nature whatsoever arising therefrom, excepting only those claims, if any, already notified to the District in writing, and acknowledges that it will henceforth look only to the Contractor for the discharge of the District's obligations thereunder and that only the Contractor may exercise the rights of the District thereunder.

5 Henceforth, the terms and conditions of the Construction Contract insofar as they can apply to a subcontract shall govern the relations between the Contractor and the Supply Contractor; provided nevertheless, that if any term of the Construction Contract is inconsistent with any payment provision or Special Condition or Special Provision in the Supply Contract such payment provision, Special Condition or Special Provision of the Supply Contract shall prevail.

6 The District and Supply Contractor agree that the Supply Contract between them has been terminated.

7 It is agreed that as of the date hereof [$_____] is owing to the Supply Contractor under the Supply Contract.

IN WITNESS WHEREOF the parties hereto have executed this Agreement as follows:

DISTRICT OF SOOKE

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

ALFA LAVAL INC.

by its authorized signatory on_____day of____, 2019:
SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

Appendix 7

SUPPLY CONTRACTOR AGREEMENT

CONTRACT AGREEMENT

THIS AGREEMENT made this 10th day of July, 2019.

BETWEEN: ALFA LAVAL INC. (the "Supply Contractor")

AND: District of Sooke (the "District")

THIS AGREEMENT WITNESSES that the Supply Contractor and the District agree as follows:

1. The Supply Contractor shall provide all labour, materials, equipment, supplies and all other items required to supply the Goods and perform all other Work within the required time, as required by the Contract Documents.

2. The District shall pay the Supply Contractor the Contract Price, as required by the Contract Documents.

3. The Contract Price shall be the sum in Canadian Dollars of the following:

   .1 the tender price, as set out Section 00 20 00, and

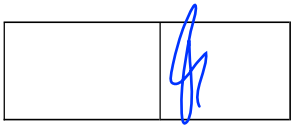
   .2 any payments made on account of changes, as may be required by the Contract Documents.

   The Contract Price shall be the entire compensation payable to the Supply Contractor by the District for the Goods other Work and shall cover and include necessary costs including but not limited to all supervision, labour, materials, equipment, supplies and all other items, overhead, profit, financing costs, duty, shipping charges, fabrication and finishing, storage as required, conveyance and delivery, packing, crating, freight, cartage, drafting charges, tariffs, warranty and all other costs and expenses whatsoever incurred in performing the Contract.

4. The Supply Contractor shall supply all Goods to the Delivery Point no later than the dates shown on Section 00 20 00 Schedule 2, including revisions under Section 00 50 00, Item 7.1.2, if any.

5. The Contract Documents shall form a part of this Agreement.

6. The Contract supersedes all prior negotiations, representations or agreements, whether written or oral and is the entire agreement between the District and the Supply Contractor with respect to the subject matter of this Agreement.



Capitalized terms in this Agreement shall have the meanings as set out in Section 00 50 00, Clause 1.1.

7. The Supply Contractor shall not assign the Contract, or any portion of the Contract, or any payments due or to become due under the Contract, without the express written consent of the District.

8. No action or failure to act by the District or an authorized representative of the District shall constitute a waiver of any right or duty afforded any of them under the Contract or constitute an approval or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

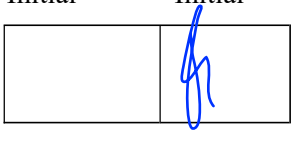
9. This Agreement shall enure to the benefit of and be binding upon the District and the Supply Contractor and their respective heirs, executors, legal representatives, successors and permitted assigns. In the event of more than one person being the Supply Contractor, such persons shall be jointly and severally liable for all of the representations, warranties, covenants and obligations of the Supply Contractor under the Contract.

10. Time shall be of the essence of this Agreement.

11. This Agreement is governed by the laws of British Columbia, Canada.

12. This Contract Agreement will be assigned to the General Contractor once that contract is awarded. (Estimated to be by late 2019).

13. As of the date of the signing of this Agreement, the Parties acknowledge that the potential development, scope and impact caused by or related to the novel corona virus (COVID-19) is unpredictable and may affect the performance of obligations hereunder. In consequence of this, the Parties agree that, should the Seller's performance of works, obligations, delivery or supply hereunder be impeded, hindered or made unreasonably onerous due or related to COVID-19 (and regardless of whether or not this would constitute Force Majeure or be considered as foreseeable), the Seller shall be released, without assuming any liability, from its obligations to perform any such works or obligations until the time when such performance is again reasonably possible and Seller is able to reassume performance. Without limiting the generality of the forgoing, such situation may, by example and without limitation, occur if Seller's workforce, supply chain, and/or production is affected by COVID-19, e.g. by way of: changes in law or regulations; authority recommendations; quarantines, travel restrictions or similar circumstances; or if the Seller is reasonably unable to source or deliver required materials; or in the event of material cost increases due or related to COVID-19



14. "Force Majeure" means an event which are beyond the control of the invoking Party, which are unforeseeable and unavoidable and/or insurmountable and which were not known at the acceptance of an Order and which prevent total or partial performance by the invoking Party. Force Majeure shall include, but not be limited to, war, hostilities and military operations, riots, disorder, natural disasters, fires, epidemics and/or pandemics (and specifically in relation hereto and notwithstanding anything else stated herein, whether or not outbreak of such epidemic or pandemic has occurred prior to signing of this Contract) and judgements, decisions and/or recommendations from authorities that leads to a shortage of workforce, materials and/or goods, or that in any other way prevents the invoking Party's ability to perform in accordance with this contract or an Order. Strikes, lock-outs or other industrial action or disputes solely related to the Party and/ or its subcontractor(s) or agent(s) shall not be deemed as events of Force Majeure.

    At the time of the signing of this Contract, the Parties are aware of and acknowledges the existence of the pandemic of COVID-19. A Party shall, notwithstanding what is stated above, have the right to invoke this Section if its performance under or in connection to this Contract or an Order is prevented due circumstances related to COVID-19, including, but not limited to, for reason of judgements, decisions and/or recommendations from authorities that leads to a shortage of workforce, materials and/or goods, or that in any other way prevents the invoking Party's ability to perform in accordance with this Contract or an Order, and any such circumstance shall be deemed as events of Force Majeure.]

    If an event of Force Majeure occurs, the invoking Party's contractual obligations affected by such an event shall be suspended during the period of delay caused by the Force Majeure event.

    The Party claiming Force Majeure shall promptly inform the other Party in writing and shall within ten (10) days thereafter furnish evidence of the occurrence and expected duration of such Force Majeure.

    In the event of Force Majeure, the Parties shall immediately consult with each other in order to find an equitable solution and shall use all reasonable endeavours to minimize the consequences of such Force Majeure. If the consequences of the Force Majeure event continue for a period of ninety (90) days without a solution acceptable to both Parties, either Party shall be entitled to terminate the Order with immediate effect.

IN WITNESS WHEREOF the parties hereto have executed this Agreement as follows:

DISTRICT OF SOOKE

by its authorized signatory on _____ day of _____, 2020:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on 9th day of April, 2020:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: Derek Gluschenko

Title: Regional Sales Manager, British Columbia, Alfa Laval Inc. Canada

Signature: _____

Name: John Goswell

Title: GM, Food & Water Division, Alfa Laval Inc. Canada

END OF SECTION

SUPPLEMENTARY GENERAL CONDITIONS

Contract: WWTP UPGRADE 2020

TABLE OF CONTENTS

The Canadian Construction Documents Committee, Standard Construction Document CCDC 2 – Stipulated Price Contract, 2008, is hereby modified as follows:

AGREEMENT BETWEEN *OWNER* AND *CONTRACTOR*

ARTICLE A-5 PAYMENT

5.1 **(delete and replace article 5.1 as follows)**
Subject to provisions of the Contract Documents, and in accordance with the Builders Lien Act *(British Columbia), the* Owner *shall in Canadian funds:*

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

.2 upon Substantial Performance of the Work, pay to the Contractor the unpaid balance of the holdback amount when due together with such Value Added Taxes as may be applicable to such payment, and

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

ARTICLE A-9 NO DUTY OF CARE

(add new Article A-9 No Duty of Care)

9.1 **(add new article 9.1 as follows)**
The *Contractor* acknowledges that the *Owner*, in the preparation of the Contract Documents, supply of oral or written information to Tenderers, review of Tenders or the carrying out of the *Owner's* responsibilities under the Contract does not owe a duty of care to the *Contractor* and the *Contractor* waives for itself and its successors the right to sue the *Owner* in tort for any loss, including economic loss, damage, cost or expense arising from or connected with any error, omission or misrepresentation occurring in the preparation of the Contract Documents, supply of oral or written information to Tenderers, review of tenders or the carrying out of the *Owner's* responsibilities under the Contract.

DEFINITIONS

19. **(delete and replace article 19 as follows)**
"Subcontractor" means an Owner approved person, firm or corporation undertaking the execution of a part of the *Work* by virtue of an agreement with the Contractor.

20. **(delete and replace article 20 as follows)**
"Substantial Performance of the Work" means the stage of completion of all of the *Work*, as certified by the *Payment Certifier*, when:

.1 a) the *Work* is ready for use or is being used for its intended purpose; **and**

b) the total of the incomplete, defective, and deficient Work can be completed at an estimated cost of no more than:

3% of the first $500,000 of the *Contract Price*
2% of the next $500,000 of the *Contract Price*
1% of the balance of the *Contract Price*

.2 For the purposes of this *Contract* where the *Work* or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the *Work* cannot be completed expeditiously for reasons beyond the control of the *Contractor* or, where the *Owner* and the *Contractor* agree not to complete the *Work* expeditiously, the price of the services or materials remaining to be supplied and required to complete the *Work* shall be deducted from the *Contract Price* in determining *Substantial Performance*.

27. ***(add new article 27 as follows)***
"Provide" or "Provision of" means supply and placement of an item.

28. ***(add new article 28 as follows)***
"Payment Certifier" means the *Consultant*, who shall be the payment certifier responsible for payment certifications of the *Contractor* under the *Builders Lien Act*. The *Contractor* shall be the person responsible for payment certification for all subcontractors, including the *Subcontractors,* as required under the *Builders Lien Act*.

29. ***(add new article 29 as follows)***
"Builders Lien Act" means the *Builders Lien Act*, S.B.C. 1997, c.45, as the same may be amended from time to time.

30. ***(add new article 30 as follows)***
"Quality Assurance" means the process by which the *Owner* evaluates if the *Work* is being constructed in accordance with the *Contract Documents.*

31. ***(add new article 31 as follows)***
"Quality Control" means the process by which the *Contractor* checks specific materials, products, and workmanship to ensure strict conformance with the *Contract Documents.*

32. ***(add new article 32 as follows)***
"Superintendent" means the *Contractors* senior representative at the *Place of the Work*.

33. ***(add new article 33 as follows)***
"Contract Administrator" *or* ***"Engineer"*** *shall both have the same meaning as "Consultant".*

34. ***(add new article 34 as follows)***
"Addendum" means an addition to or a change in the *Contract Documents* that is issued by the *Owner* prior to the Tender closing.

35. ***(add new article 35 as follows)***
"Final Acceptance" means the final acceptance of the *Work* by the *Owner* following the correction of all defects and deficiencies and the expiry of all applicable warranty periods under the provisions of GC 12.3 –WARRANTY including, without limitation, any warranty period under GC 12.3.7.

36. ***add new article 36 as follows)***
"Total Performance of the Work" means when the entire *Work*, except those items arising from the provisions of GC 12.3 - WARRANTY, has been performed to the requirements of the *Contract Documents* and is so certified by the *Consultant*.

    In addition to all prior requirements, *Total Performance of the Work* will not occur until the *Work* has passed all inspections and testing requirements.

37. ***(add new article 37 as follows)***
"Consultant's Representative" means any person authorized from time to time by the *Consultant* to perform the duties of the *Consultant* whose authority shall be notified in writing to the *Contractor* by the *Consultant*.

38. ***(add new article 38 as follows)***
"Notice of Award" has the meaning as set out in paragraph 5.1 of the Form of Tender.

39. ***(add new article 39 as follows)***
"Notice to Proceed" has the meaning set out in paragraph 5.1.2 of the Form of Tender.

40. ***(add new article 40 as follows)***
"Prime Contractor" has the meaning assigned in Section 118 of the *Workers Compensation Act* (British Columbia).

41. ***(add new article 41 as follows)***
"Daily force account sheet" has the same meaning as "daily extra work order sheet", "daily work records", or, "daily time sheet."

Part 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

1.1.7 ***(delete and replace article 1.1.7 as follows)***
If there is any inconsistency or conflict between the provisions of the *Contract*

Documents then:
the *Contract Documents* shall govern and take precedence in the following order with the Agreement taking precedence over all other *Contract Documents*:

a. Agreement
b. Addenda
c. Supplementary General Conditions
d. General Conditions
e. Supplementary Specifications
f. Specifications
g. Drawing List as shown on Drawing C000 issued April 2017
h. Master Municipal Construction Documents, Platinum 2009 edition Standard Detail Drawings
i. Executed Form of Tender
j. Instructions to Tenderers
k. All other Contract Documents

GC 1.4 ASSIGNMENT

1.4.2 ***(add new article 1.4.2 as follows)***
No assignment of this *Contract* in whole or in part shall be valid unless it shall contain a provision that the funds to be paid to the assignee under the assignment are subject to the prior lien for services rendered or material supplied for the performance of the *Work* called for in the *Contract* in favour of persons, firms, or corporations rendering such services or supplying such materials.

GC 1.5 RECORD DOCUMENTS

1.5 ***(add new General Condition section 1.5 RECORD DOCUMENTS)***

1.5.1 ***(add new article 1.5.1 as follows)***
The *Contractor* shall keep one set of *Contract Drawings* on the site at all times. As the *Work* progresses, the *Contractor* shall record, in a neat legible manner, all changes in the work. The following information shall be recorded for each change:

a. Full Description of change
b. Date
c. Authority

1.5.2 ***(add new article 1.5.2 as follows)***
At the completion of *Work*, the set of *Contract Drawings* referred to in article 1.5.1 shall be forwarded to the *Consultant* for incorporation in a set of "RECORD" drawings for this project.

Part 2 ADMINISTRATION OF THE CONTRACT

GC 2.1 AUTHORITY OF THE CONSULTANT

2.1.4 ***(add new article 2.1.4 as follows)***
Nothing contained in the *Contract Documents* shall create any contractual relationship between the *Consultant* and the *Contractor, Subcontractors, Suppliers*, or their agents, employees or other persons performing any of the *Work.*

GC 2.3 REVIEW AND INSPECTION OF THE WORK

2.3.8 ***(add new article 2.3.8 as follows)***
If the *Consultant* is required to make visits for the purpose of witnessing the testing of equipment or materials, or the factory inspection of equipment or materials on more than one occasion for the same piece of equipment or materials, by reason of delays of the *Contractor*, or malfunctioning of the equipment under test, or from whatever reason caused by the *Contractor* or his subcontractors, the *Contractor* shall pay to the *Owner* the additional fees and expenses incurred for the second and any such subsequent extra visits by the *Consultant* and charged by the *Consultant* to the *Owner*.

GC 2.5 TESTS AND INSPECTIONS

(add new General Condition section 2.5 TESTS AND INSPECTIONS)

2.5.1 ***(add new article 2.5.1 as follows)***
The tests and inspections required by the *Contract Documents* are for the *Owner's* benefit as part of the *Owner's Quality Assurance* program. Acceptable test and inspection results will not relieve the *Contractor* of its obligations under the *Contract* to correct defects or deficiencies in the *Work.*

2.5.2 ***(add new article 2.5.2 as follows)***
The *Owner* may reject *Work* completed prior to a failed *Quality Assurance* test if there are not subsequent satisfactory tests indicating that the *Work* is satisfactory.

2.5.3 ***(add new article 2.5.3 as follows)***
All *Quality Control* test results must be made available to the *Consultant* within one (1) day of their availability to the *Contractor*.

2.5.4 ***(add new article 2.5.4 as follows)***
The *Contractor* shall as part of the *Work* perform, or cause to be performed, all tests, inspections and approvals of the *Work* as required by the *Contract Documents*, and if a test, inspection or approval requires a representative sample of materials or workmanship the *Contractor* shall at the *Contractor's* own cost supply the labour and materials necessary to provide the sample.

2.5.5 ***(add new article 2.5.5 as follows)***
If any portion of the *Work* is designated for special tests, inspections or approvals (either as a requirement in the *Contract Documents*, or by the *Consultants*

instructions, or by the laws and regulations applicable at the *Place of the Work* , then:

1. if the *Consultant* is to perform or arrange for the test, inspection or approval, the *Contractor* shall give the *Consultant* timely notice requesting such test, inspection, or approval; and
2. if other authorities are to perform the test, inspection or approval, the *Contractor* shall arrange for such test, inspection or approval and shall give the *Consultant* timely notice of the date and time for such test, inspection, or approval.

2.5.6 ***(add new article 2.5.6 as follows)***

The *Contractor* will comply with any orders or directions given by the *Consultant* for inspection or testing that was not called for in the *Contract Documents,* and have such inspection or testing undertaken.

1. If the *Consultant* orders that such inspection or testing, that was not called for in the *Contract Documents*, be carried out in advance of the *Work* then the order shall be treated as a *Change Order.*
2. If the *Consultant* orders that such inspection or testing that was not called for in the *Contract Documents*, be carried out on *Work* that is completed then the following applies: if the inspection or testing determines that the *Work* is not in accordance with the requirements of the *Contract Documents*, then the *Contractor* shall correct such *Work* and pay the costs of the inspection and testing and all costs of the correction and the restoration; if the inspection or testing determines that the *Work* is in accordance with the requirements of the *Contract Documents*, then the *Owner* shall pay all costs of the inspection and testing and the restoration

2.5.7 ***(add new article 2.5.7 as follows)***

If the *Contractor* disagrees with the *Consultant's* determination of the *Work* not meeting the *Specifications* based on the results of inspection or testing required in the *Contract Documents* or ordered by the *Consultant*, the *Contractor* may elect to carry out such furtherinspection or testing which the *Consultant* agrees is acceptable for the purpose of determining whether the *Work* complies with the requirements of the *Contract Documents*.

1. If such further inspection or testing determines that the *Work* is not in accordance with the requirements of the *Contract Documents*, then the *Contractor* shall correct such *Work* and pay the costs of the inspection and testing including all costs of the correction and subsequent inspection and testing.
2. If such further inspection or testing determines that the *Work* is in accordance with the requirements of the *Contract Documents*, then the *Owner* shall pay all costs of the inspection and testing.

2.5.8 ***(add new article 2.5.8 as follows)***

If the *Contractor* covers or permits to be covered *Work* that has been designated for tests, inspections or approvals, before such tests, inspections or approvals are made, given or completed, the *Consultant* may direct the *Contractor* to

uncover such *Work,* in order that the inspections or tests may be satisfactorily completed, and make good such *Work* at the *Contractor's* own expense, and the *Contractor* shall comply with such direction

2.5.9 ***(add new article 2.5.9 as follows)***
The *Contractor* shall promptly provide the *Consultant* with two (2) copies of all certificates, inspection and testing reports required by the *Contract Documents* or ordered by the *Consultant*.

2.5.10 ***(add new article 2.5.10 as follows)***
The *Contractor* shall not undertake any *Work* outside the working hours, as specified in the *Contract Documents* (if so specified), which under the *Contract Documents* requires tests, inspection, or approval by the *Consultant* unless the *Contractor* obtains the *Consultant's* prior approval. The *Contractor* shall reimburse the *Owner* for any additional costs incurred to provide tests, inspections, or approvals outside such specified working hours.

Part 3 EXECUTION OF THE WORK

GC 3.1 CONTRACTOR'S RESPONSIBILITY AND CONTROL OF THE WORK

(delete GC 3.1 title CONTROL OF THE WORK and replace with CONTRACTOR'S RESPONSIBILITY AND CONTROL OF THE WORK)

3.1.3 ***(add new article 3.1.3 as follows)***
The *Contractor* shall commence the *Work* within 10 days after receiving *Notice to Proceed* from the *Owner*. The *Contractor* will not commence the work until the *Contract* has been officially accepted by the *Owner*, the Insurance Certificates and the Performance Bonds are satisfactory to the *Owner*, and the *Contractor* has received *Notice in Writing* from the *Consultant* to commence the *Work*.

3.1.4 ***(add new article 3.1.4 as follows)***
The *Contractor* shall provide for efficient drainage of all sections of the *Work* during all stages of construction at the *Contractor's* own expense. The *Contractor* will be held responsible for all damage which may be caused through the *Contractor's* failure to provide proper drainage facilities. The Contractor shall restore any existing drainage works which are disturbed because of the Contractor's construction activities.

3.1.5 ***(add new article 3.1.5 as follows)***
In order to assist the *Owner* in inspecting the progress of the *Work*, the *Contractor* shall prepare a Schedule of *Work* prior to commencing the *Work* and shall revise the schedule weekly for any changes throughout the *Contract*.

3.1.6 ***(add new article 3.1.6 as follows)***
Prior to commencement of construction, the *Consultant* and the *Contractor* will locate on site those survey pins, baselines and benchmarks which are necessary to delineate the Working Area and to lay out the *Work*, all as shown on the *Contract Drawings*.

3.1.7 ***(add new article 3.1.7 as follows)***
The *Contractor* shall be responsible for the preservation of all survey pins while the *Work* is in progress. Any survey pins disturbed, damaged, or removed by the *Contractor's* operations shall be replaced under the supervision of a British Columbia Land Surveyor, at the sole cost of the *Contractor*.

3.1.8 ***(add new article 3.1.8 as follows)***
The *Contractor* will give the *Consultant* at least 48 hours' notice in writing before requiring any baselines or benchmarks in connection with the *Work*. The *Contractor* shall clearly state in such notice the exact location where levels, lines, or stakes are required. The *Contractor* must satisfy himself before commencing any *Work* as to the meaning and correctness of all stakes and marks, and no claim will be entertained by the *Owner* for or on account of any alleged inaccuracies, unless the Contractor notified the *Consultant* of such inaccuracies in writing before commencing the *Work*.

The *Contractor* is responsible for the preservation of all stakes and marks in their proper positions, and where any of them are disturbed, lost or destroyed, it shall at once notify the *Consultant* in writing, and all expenses incurred in replacing such stakes or marks will be billed against the *Contractor* and if not paid by the *Contractor* will be deducted from any monies due the *Contractor* under the *Contract*.

All stakes and marks set will not in every case represent all the grades, levels, lines, angles or surfaces in the finished *Work* and in this regard the *Contractor* shall ensure that such stakes and marks are read correctly and used in a manner consistent with the plans, details, specifications and directions of the *Consultant*. Should the *Contractor* discover or suspect any errors in stakes, lines, and grades which have been established for its use, the *Contractor* shall at once discontinue the *Work* until such suspicions are investigated and any errors or misunderstandings rectified, but no claims shall be made or allowed on this account, or because of any resulting delay.

The *Contractor* shall assume full responsibility for alignment, elevations, and dimensions of each and all parts of the *Work*, regardless of whether the *Contractor's* layout work has been checked by the *Consultant*.

The *Contractor* shall furnish the *Consultant* or any of his assistants with all reasonable help which may be required at any time in driving stakes or laying out the work. The *Contractor* will receive no additional compensation for this.

GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

3.2.7 ***(add new article 3.2.7 as follows)***
If the performance of the *Contract* is likely to be interfered with by the simultaneous execution of some other contract or contracts, the *Consultant* shall decide which contractor shall cease work temporarily and which contractor shall continue, or whether the work under the contracts can be coordinated so the contracts may proceed simultaneously. The *Owner* shall not be responsible for any damages suffered or extra costs incurred by the *Contractor*, resulting directly or indirectly from the award or performance or attempted performance of any

other contract or contracts on the project, or caused by any decision or omission of the *Consultant* respecting the order of precedence in the performance of the contracts other than for the extension of time.

GC 3.6 SUPERVISION

3.6.1 ***(delete and replace article 3.6.1 as follows)***
The *Contractor* shall provide all necessary supervision and appoint a competent representative who shall be in attendance at the *Place of the Work* while work is being performed. The appointed representative shall not be changed except for valid reason and any change shall require the approval of the *Owner* which shall not be reasonably withheld.

3.6.3 ***(add new article 3.6.3 as follows)***
To coordinate the *Work*, the *Contractor* or person(s) authorized to act for the *Contractor* will attend weekly meetings with the *Consultant* or his representative during the period over which the work under the *Contract* is carried out, at a time and place to be decided by the *Consultant*.

3.6.4 ***(add new article 3.6.4 as follows)***
The *Contractor* shall employ a competent senior representative at the *Place of the Work* (the "*Superintendent*") who shall have the responsibility to ensure that the *Work* is performed in compliance with the *Contract Documents.* The *Contractor* shall also employ necessary assistants for the *Superintendent* and the *Superintendent* and assistants shall be in attendance at the *Place of the Work* while *Work* is being performed.

3.6.5 ***(add new article 3.6.5 as follows)***
The *Superintendent* shall represent the *Contractor* at the *Place of the Work* and instructions given to the *Superintendent* by the *Consultant* shall be held to have been given to the *Contractor.*

3.6.6 ***(add new article 3.6.6 as follows)***
If the competence or performance of the *Superintendent* is not satisfactory to the *Consultant* then, on written request from the *Consultant*, the *Contractor* shall provide a satisfactory replacement. The *Contractor* shall not change the *Superintendent* without the consent of the *Consultant,* such consent not to be unreasonably withheld.

GC 3.7 SUBCONTRACTORS AND SUPPLIERS

3.7.1 ***(add new article 3.7.7 as follows)***
The *Contractor* is required to co-ordinate delivery, receive, protect, and store all *Owner* supplied equipment.

GC 3.8 LABOUR AND PRODUCTS

3.8.4 ***(add new article 3.8.4 as follows)***
The *Contractor* shall keep records which are to be open for inspection. The *Contractor* shall keep proper books and records showing the names, trades, addresses and hourly wage rates of all employees in *the Contractor's* employ and the wages paid to and time worked by such employees both at regular wage

rates and at overtime wage rates, and the books or documents containing such records shall be open for inspection by Officers of the Ministry of Labour, British Columbia, at any time it may be expedient to the Minister of Labour to have the same inspected.

GC 3.9 USE OF THE WORK

3.9.3 ***(add new article 3.11.3 as follows)***
Without limiting article 3.11.1, the *Contractor* shall comply with the *Contract Administrator* instructions regarding signs, advertisements, fires, and smoking.

The *Place of Work* shall always be kept free of rubbish and unnecessary hazards to persons, materials, and equipment.

3.9.4 ***(add new article 3.11.4 as follows)***
Local traffic shall be provided access to private properties at all times.

Emergency traffic such as Police, Fire, and Disaster Units shall always be provided reasonable access. The *Contractor* shall be liable for any damage which may result from his failure to provide such reasonable access.

3.9.5 ***(add new article 3.11.5 as follows)***
If required by the *Owner*, the *Contractor* shall submit a Traffic Management Plan for approval prior to start of construction in which the extent and duration of any road closures associated with the work are identified. Two-way traffic via one open lane shall always be maintained on public roads unless the *Contractor* has obtained the *Owner's* approval via a Road Closure Permit. The *Contractor* is cautioned that approval of full road closures is not guaranteed. Traffic control on all roads shall be in strict accordance with the Traffic Control Manual for Work on Roadways published by the Ministry of Transportation and Highways. The *Contractor* shall only use appropriately accredited personnel for Traffic Control.

3.9.6 ***(add new article 3.11.6 as follows)***
The *Contractor* shall provide clean sanitary latrine accommodations for the use of *the Contractor's* employees as may be necessary to comply with the requirements and regulations of the Ministry of Health and other bodies having jurisdiction. The *Contractor* shall permit no public nuisance.

3.9.7 ***(add new article 3.11.7 as follows)***
The *Contractor* shall maintain the working area in a tidy condition and free from the accumulation of debris.

3.9.8 ***(add new article 3.11.8 as follows)***
The *Contractor* shall ensure that during night work the *Place of Work* is adequately floodlit and shall comply with all reasonable directions of the *Consultant* in that regard.

3.9.9 ***(add new article 3.11.9 as follows)***
Streets beyond the limits of the *Work* and other construction areas shall be kept clean by the *Contractor*. Dusty materials shall be transported in covered haulage vehicles. Wet materials shall be transported in suitable watertight haulage vehicles.

3.9.10 ***(add new article 3.11.10 as follows)***
The *Contractor* shall take such steps as may be required to prevent dust nuisance resulting from its operations either within the limits of the *Work* or elsewhere or by public traffic where it is the *Contractor's* responsibility to maintain a roadway through the *Work*.

3.9.11 ***(add new article 3.11.11 as follows)***
Where the *Work* requires the sawing of asphalt or the sawing or grinding of concrete, blades and grinders of the wet type shall be used together with sufficient water to prevent the incidence of dust, wherever dust would affect traffic or wherever dust would be a nuisance to residents of the area where the *Work* is being carried out.

GC 3.13 CLEANUP

3.13.4 ***(add new article 3.13.4 as follows)***
In hauling of material to and from the *Place of Work*, the routes to be followed by trucks shall be confined to designated arterial and collector roads as shown on the road classification plan as issued by the *Owner*. Where a dumpsite can only be accessed by way of a local road, the route shall be the shortest possible way from an arterial or collector road and shall be agreed to by the *Contract Administrator* in advance of the *Work*. The *Contractor* shall be responsible for road cleanup along all trucking routes used in association with the *Work*. The cost of this cleanup shall be paid by the *Contractor* and considered incidental to the *Work*. The *Contractor* shall be responsible for obtaining and securing a legal dumpsite. All costs associated with that dumpsite shall be the responsibility of the *Contractor* and shall be considered incidental to the *Work*.

3.13.5 ***(add new article 3.13.5 as follows)***
Prior to disposal of any wood debris, organic debris and/or waste excavated material, the *Contractor* shall submit a disposal management strategy in accordance with all applicable laws, bylaws, and regulations to the *Consultant* for approval. Subject to the *Consultant's* approval, the *Contractor* shall ensure that all wood debris, organic debris and/or waste excavated material that is removed from the work site is managed in accordance with this approved disposal management strategy. The *Contractor* shall be required to employ acceptable methods of disposal, approved disposal site location(s), and shall be required to obtain and submit copies of all relevant permits and/or approvals prior to the disposal of any wood debris, organic debris and/or waste excavated material

Regardless of the aforementioned, the *Owner* reserves the right to disallow any or all of the *Contractor*'s proposed disposal management strategy if it is determined that they will result in undesirable environmental impacts.

GC 3.14 COMMUNICATIONS PROTOCOL

(add new General Condition section 3.14 COMMUNICATIONS PROTOCOL)

3.14.1 ***(add new article 3.14.1 as follows)***
All communications to and from the *Contractor* shall go through the *Consultant*.

The *Contractor* shall not take any direction from *Owner's* operation staff except under emergency situations.

Part 5 PAYMENT

GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

5.2.1 ***(delete and replace article 5.2.1 as follows)***
Application for payment on account as provided in Article A-5 of the Agreement - PAYMENT may be made monthly as the *Work* progresses, and in accordance with subsection GC 5.2.1.1 which follows:

5.2.1.1 ***(add new article 5.2.1.1 as follows)***
Notwithstanding Paragraph GC 5.2.7 the *Owner* may withhold any or all payments to the *Contractor* or portions thereof in circumstances where the *Contractor* is considered by the *Owner* or *Consultant* to be unreasonable or in default of specified times for completion of the *Work*.

5.2.8 ***(add new article 5.2.8 as follows)***
Applications for payment on account may be made monthly as the *Work* progresses. The *Contractor* shall present to the *Consultant* two (2) copies of the estimate that he has certified to be correct. Two (2) copies of each progress payment certificate shall be delivered by the *Consultant* to the *Contractor*. Upon receipt of the progress payment certificate verified as aforesaid and upon its approval by the *Consultant*, the *Owner* will process the payment to the *Contractor*.

GC 5.3 PROGRESS PAYMENT

5.3.1.3 ***(delete and replace article 5.3.1.3 as follows)***
The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement - payment no later than 30 days after the date of Certificate for Payment issued by the *Consultant*.

a. The *Contractor* shall furnish the *Consultant* with satisfactory evidence in the form of a WorkSafeBC “Clearance Letter” that the *Contractor* has made suitable provision for meeting any liability under the *Workers Compensation Act* (British Columbia), prior to the release of any monthly progress payment.
b. The *Contractor* shall furnish the *Consultant* with a Statutory Declaration that all liabilities incurred by the *Contractor* and its sub-contractors in carrying out the *Contract* have been discharged and that all liens in respect of the *Contract* have expired or have been satisfied, discharged or provided for by payment. The Statutory Declaration shall be provided prior to all monthly progress payments except the first one.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

5.4.4 ***(add new article 5.4.4 as follows)***
Notwithstanding the obligation of the *Owner* to release any builder’s lien

holdback pursuant to article 5.5.4, the *Owner* may hold back (without interest) the following amounts from the *Contractor*:

1. 200% of a reasonable estimate, as determined by the *Contract Administrator*, on account of defective or deficient *Work* already paid for, such holdback to be held until such defect or deficiency is remedied.
2. The reasonable estimate, as determined by the *Contract Administrator* in consultation with the *Contractor*, of the amount in excess of the *Contract Price* that it would cost the *Owner* to have others complete *Work* that the *Contractor*, following *Substantial Performance of the Work*, is unable to complete because of climatic or other conditions beyond the *Contractor's* reasonable control.
3. An amount equal to any lien filed with respect to the *Work*, plus 15% as security for costs, which holdback may, upon 5 days' written notice to the *Contractor*, be paid by the *Owner* into court to discharge the lien or, if the lien is discharged without payment of the holdback into court, the *Owner* shall pay such holdback to the *Contractor*.

5.4.5 ***(add new article 5.4.5 as follows)***

The *Consultant* shall be the *Payment Certifier* responsible under Section 7 of the *Builders Lien Act* for certifying *Substantial Performance* of the *Work* of the *Contractor*, but not the *Work* of *Subcontractor*s. The *Contractor* shall co-operate with and assist the *Consultant* by providing information and assistance in a timely manner as the *Consultant* considers necessary to carry out the duties of the *Payment Certifier* for the Contract.

The *Contractor* shall be the *Payment Certifier* responsible under Section 7 of the *Builders Lien Act* for certifying *Substantial Performance* of the *Work* of each *Subcontractor*. Prior to certifying completion for a *Subcontractor*, the *Contractor* shall consult with the *Consultant* and obtain the *Consultant's* comments on the status of completion by the *Subcontractor,* including any deficiencies or defects in the *Subcontractor's Work* noted by the *Consultant*. The *Contractor* will indemnify and save the *Owner* harmless from any and all liability the *Owner* may have to anyone arising out of the certification by the *Contractor* of *Substantial Performance* for that *Subcontractor.*

5.4.6 Notwithstanding any other provision of the *Contract,* no payments will be due or owing to the *Contractor* so long as a Lien filed by anyone claiming under or through the *Contractor* remains registered against the Project or any lands, or interest therein, on which *Work* for the project was performed. Failure of the *Contractor* to remove all Liens promptly will entitle the *Owner* to damages

GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

5.5.1.2 ***(delete and replace article 5.5.1.2 as follows)***

The *Contractor* shall furnish to the *Owner* a statutory declaration, dated not earlier than 7 days after expiry of the statutory lien period stating that no lien claim has been filed against title to the lands of the *Owner* or the lands of any

other person and stating that all materials, labour, work and services incurred directly or indirectly on account of the *Work* have been paid for by the *Contractor*.

5.5.1 ***(delete article 5.5.3 in its entirety)***

5.5.6 ***(add new article 5.5.6 as follows)***
The *Owner* shall hold back 10%, or other percentage as required by the *Builders Lien Act,* of any amounts due to the *Contractor* as a builder's lien holdback.

5.5.7 ***(add new article 5.5.7 as follows)***
The *Owner* will retain a holdback but will not establish a Holdback Trust Account pursuant to Section 5 of the *Builders Lien Act.*

GC 5.7 FINAL PAYMENT

5.7.4 ***(delete article 5.7.4 and replace as follows)***
Subject to the provision of paragraph 10.4.1 of GC 10.4 WORKERS' COMPENSATION, and any lien legislation applicable to the *Place of the Work,* the *Owner* shall, no later than thirty (30) days after the issuance of a final certificate for payment, pay the *Contractor* as provided in Article A-5 of the Agreement - PAYMENT.

Part 6 CHANGES IN THE WORK

GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

6.1.3 ***(add new article 6.1.3 as follows)***
When the valuation of a change in the work is to be determined either by estimate and acceptance in a lump sum, or by cost and fixed, or, percentage fee, the valuation shall be in accordance with the following:

a. **Mark Up –** Cost of net increases or decreases to contract value due to changes in the work shall be marked up as follows:
   - *Contractor's* Own *Work*: 10% of actual base costs.
   - *Sub-contractor's* Own *Work*: 10% of actual base costs.
   - *Sub-contractor's Work*: *Contractor's* mark-up is 5% of actual base costs.

b. **Substantiation –** When requested, the *Contractor* shall submit details, quantities, prices, and fees together with substantiating documentation.

c. **Time for Submission and Acceptance of Quotation –** The *Contractor* shall co-operate in the pricing of changes by submitting quotations within ten (10) calendar days of the *Consultant's* request. Quotations shall remain open for acceptance for twenty-one (21) calendar days from the date of submission.

d. **Other Methods for the Valuation of Changes -** The *Consultant* shall determine the amount, if any, to be added to, or deducted from, the sum named in the tender, in respect of any changes ordered. All such work shall be valued at the prices set out in the Form of Tender if such are applicable in the opinion of the Engineer.

If this *Contract* does not contain any prices applicable to changes requested, then the *Contractor* and *Consultant* may agree on a price which shall be comparable to prices quoted on work of a similar nature.

Valuation methods presented in the construction documents are mutually exclusive in terms of their application.

GC 6.3 CHANGE DIRECTIVE

6.3.6.1 ***(delete and replace article 6.3.6.1 as follows)***
If the change results in a net increase in the *Contractor's* cost, the *Contract Price* shall be increased by the amount calculated in accordance with Supplemental General Condition 6.1.3.

6.3.6.2 ***(delete and replace article 6.3.6.2 as follows)***
If the change results in a net decrease in the *Contractor's* cost, the *Contract Price* shall be decreased by the amount calculated in accordance with Supplemental General Condition 6.1.3.

6.3.14 ***(add new article 6.3.14 as follows)***
Upon receipt of a *Change Directive*, the *Contractor* may be directed, by either the *Owner*, or the *Consultant*, to proceed with extra work on the basis of daily force account sheets provided:

a. Pre-approved, all inclusive, labour, material, and equipment rental charge out unit rates are on file with the *Consultant*.
b. Daily force account sheets outlining, as a minimum, the unit quantities used for the day, field instruction number, project name, and date, are provided to the *Consultant* for signature, and records, on a daily basis for work completed on the previous *Working Day*.
c. *Work* shall proceed based on daily force account sheets only after the *Consultant* has issued the *Contractor* a written and numbered change directive, or field instruction, to proceed with the extra *Work*.

Whenever extra *Work* is being performed in accordance with GC 6.3.14 the *Contractor* shall submit daily force account sheets for approval to/by the *Consultant* showing the quantities of labour, materials and equipment used directly in carrying out each order for *Work* on the preceding day, together with substantiating documentation. No claim for compensation for extra *Work* will be considered in the absence of such force account sheets. The *Consultant* will not allow any compensation for the cost of repairs to equipment or for damage to anything used in performing such extra *Work*.

The *Contractor* shall not be entitled to interest on any bill for extra *Work* on account of delay in its approval by the *Consultant*, or the *Owner*.

GC 6.5 DELAYS

6.5.6 ***(add new article 6.5.6 as follows)***
If the *Contractor* is delayed in the performance of the *Work* by:

a. abnormal inclement weather; or

b. archaeological finds

then the *Contractor* shall not be reimbursed by the *Owner* for any costs incurred by the *Contractor* as the result of such delay. Any delay in the performance of the *Work* shall be considered for the extension of *Contract Time* only.

In the case of an application for an extension due to abnormal inclement weather, the *Contractor* shall, with the *Contractor's* application, submit evidence from Environment Canada in support of such application. Extension of *Contract Time* will be granted in accordance with subsection GC 6.5.3.

6.5.7 ***(add new article 6.5.7 as follows)***

If the *Contractor's* operations expose any items which may indicate an archaeological find, such as building remains, hardware, accumulations of bones, pottery, or arrowheads:

a. The *Contractor* shall immediately notify the *Consultant* and suspend operations within the area identified by the *Consultant*. *Work* shall remain suspended within that area until otherwise directed by the *Consultant* in writing.
b. Any delay in the completion date of the *Contract* that is caused by such a cessation of construction operations will be beyond the *Contractor's* control in accordance with Subsection GC 6.5.3
c. Any *Work* directed or authorised by the *Consultant* with an archaeological find will be considered as extra *Work* in accordance with Section GC 6.5.3.

6.5.8 ***(add new article 6.5.8 as follows)***

The *Owner* is not liable to pay standby time for any labour or equipment rental under this *Contract*.

6.5.9 ***(add new article 6.5.9 as follows)***

The *Contractor* shall complete this *Contract* in its entirety by the completion date specified in the Tender Form.

If the time limit specified is not sufficient to permit completion of the *Work* by the *Contractor* working a normal number of hours each day or week on a single day light shift basis, it is expected that additional and/or augmented daylight shifts will be required throughout the life of the *Contract* to the extent deemed necessary by the *Contractor* to ensure that the *Work* will be completed within the time limit specified. Any additional costs occasioned by compliance with these provisions will be considered to be included in the prices bid for the various items of *Work* and no additional compensation will be allowed, therefore.

6.5.10 ***(add new article 6.5.10 as follows)***

An extension of time may be granted in writing by the *Consultant* in his sole discretion in the event of the *Work* being delayed beyond the prescribed time for completion. Such extension shall be for such time as the *Consultant* may prescribe and the *Consultant* shall fix the terms on which such an extension may be granted. An application for an extension of time shall be made in writing by the *Contractor* to the *Owner* at least 15 days prior to the date of completion fixed by the *Contract*. Where an extension is granted, the date of expiry of all Bonds

and other Surety furnished to the *Owner* by the *Contractor* shall be extended at the expense of the *Contractor*.

6.5.11 ***(add new article 6.5.11 as follows)***
Any extension of time that may be granted to the *Contractor* shall be so granted and accepted without prejudice to any rights of the *Owner* whatsoever under this *Contract* and all of such rights shall continue in full force and effect after the time limited in this *Contract* for completion of the work and whenever in this *Contract*, power or authority is given to the *Owner* or the *Consultant* or any person to take any action consequent upon the act, default, neglect, delay, breach, non-observance or non-performance by the *Contractor* in respect of the *Work* or *Contract* of any portion thereof, such powers or authorities may be exercised from time to time, and not only in the event of the happening of such contingencies before the time limited in this *Contract* for the completion of the *Work* but also in the event of the same happening after the time so limited in the case of the *Contractor* being permitted to proceed with the execution of the *Work* under an extension of time granted by the *Owner*. In the event of the *Owner* granting an extension of time, time shall continue to be deemed strictly of the essence of this *Contract*.

6.5.12 ***(add new article 6.5.12 as follows)***
Immediately upon signing the *Contract*, the *Contractor* must review product requirements and anticipate foreseeable delivery delays in any items. If delays in deliveries of material, equipment, or articles are foreseeable, the *Contractor* shall propose substitutions or other remedial action in ample time to prevent delay in performance of the *Work*.

If such proposal is not given to the *Consultant* by the *Contractor*, the *Consultant* reserves the right to substitute more readily available products later in order to prevent delays at no additional cost to the *Owner*.

No substitution of any item will be permitted unless the specified item cannot be delivered to the job site in time to comply with the schedule and the *Consultant* has approved the substitutes.

To receive approval, proposed substitutes must equal or exceed the quality, finish, and performance of those products specified and/or shown and must not exceed the space requirements allotted on the drawings. The *Contractor* must provide documentary proof of equality.

6.5.13 **(*add new article 6.5.13 as follows*)**
as a genuine pre-estimate of the *Owner's* increased costs for the *Consultant* and the *Owner's* own staff caused by such delay an amount of $1,000 per day or pro rata portion for each calendar day that actual *Substantial Performance* is achieved after the *Substantial Performance Milestone Dates.*

GC 6.6 CLAIMS FOR A CHANGE IN A CONTRACT PRICE

6.6.7 ***(add new article 6.6.7 as follows)***
Should a lump sum method be used for determination of the value of a *Change Directive*, the *Contractor* shall determine the value of the *Change Directive* by

calculating the cost for each item contained within the *Change Directive* and applying a 10% mark up on all costs associated with the *Change Directive* for overhead and profit. All costs are required to be supported by documentation satisfactory to the *Consultant* and all applicable rates are to be satisfactory to the *Consultant.*

Part 7 DEFAULT NOTICE

GC 7.1 OWNERS RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

7.1.7 ***(add new article 7.1.7 as follows)***
The *Consultant* may stop any portion of the *Work*, if in his judgement the weather is such as to prevent the *Work* being properly done. No compensation of any kind will be made for such stoppage except an extension of time for the completion of the *Work* as provided in GC 6.5.3

7.1.8 ***(add new article 7.1.8 as follows)***
The *Contractor* shall, upon written notice from the *Consultant*, discontinue or delay any or all *Work* of base, foundation, or paving construction on any section of any road, if in the opinion of the *Consultant*, the foundation is not sufficiently compacted or settled for surfacing of the *Work* in question, and the *Work* shall not be resumed until the *Consultant* shall in writing so direct, and the *Contractor* shall not be entitled to any compensation for such stoppage or delay to the *Work*, other than an extension of time as provided in article 6.5.3.

Part 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

9.1.5 ***(add new article 9.1.5 as follows)***
When carrying out excavation work, the *Contractor* may encounter such underground utilities as sewers, storm drains, gas mains, telephone cables, power cables, communication cables and watermains. The *Contractor* shall be fully responsible for any breakage or damage to such utilities, and the *Contractor* shall pay the full cost of repairing such damages and making good any losses or damages which are caused as a result of his operation in carrying out this *Contract*.

9.1.6 ***(add new article 9.1.6 as follows)***
The *Contractor* shall locate, mark, and protect from damage or disturbance, any and all stakes, survey pins, monuments, and markers at the *Place of the Work.*

All survey stakes, pins, monuments, or markers which, in the opinion of the *Owner*, have been damaged or disturbed shall be made good following construction by a registered B.C. Land Surveyor at the *Contractor's* expense.

9.1.7 ***(add new article 9.1.7 as follows)***
The *Contractor's* Work shall be confined to the *Owner's* premises, including statutory rights-of-way easements and construction permit limits, whenever possible. The *Contractor* shall not enter upon or place materials on other private premises except by written consent of the individual *Owners* and shall save the *Owner* harmless from all suits and actions of every kind and description that might result from use of private property.

9.1.8 ***(add new article 9.1.8 as follows)***
The *Contractor* shall furnish and bear the cost of any security personnel the *Contractor* may require for protection to perform this *Contract*.

Part 10 GOVERNING REGULATIONS

GC 10.2 LAWS, NOTICES, PERMITS AND FEES

10.2.8 ***(add new article 10.2.8 as follows)***
The *Contractor* will notify, obtain inspections and approvals from, and co-operate with other organizations involved or affected by the *Work*, such as telephone, light and power, gas, railway companies, government agencies.

Part 11 INSURANCE AND CONTRACT SECURITY

GC 11.1 INSURANCE

11.1.1.1 ***(delete and replace article 11.1.1.1 as follows)***
The *Contractor* will at the *Contractor's* expense, carry with an company or companies and under policies of insurance acceptable to and approved by the *Owner* the following insurance with limits not less than shown in the respective items:

a. commercial general liability insurance applying to the operations of the *Contractor*, which coverage will include, without limitation, claims for personal injury, death or property damage, sudden and accidental pollution, contractual liability, products and complete operations, non-owned automobile liability and protective liability with respect to the activities of the *Contractor*; such insurance will be written for an amount of not less than $5,000,000 per occurrence, or such higher amount as the *Owner* may from time to time reasonably require;
b. broad form equipment insurance covering loss or damage to tools, property, and equipment of the *Contractor* or for which the *Contractor* is legally liable or responsible, in an amount equal to the full replacement value of the tools, property and equipment.
c. broad form builders risk insurance in an amount equal or greater to the value of the Tender amount. Such policy shall provide coverage on an "all risks" basis, including the perils of flood and earthquake, and shall be in full force and effect from the commencement of construction, until the completion of

testing and commissioning, or such other later in-service date as may be applicable;

d. automobile liability insurance to a limit of liability of not less than
e. $5,000,000 in any one accident, covering all licensed motor vehicles owned or leased by the *Contractor* and used in connection with the construction of the *Work*;
f. workers compensation insurance coverage as required pursuant to applicable legislation; and
g. any other form of insurance as the *Owner* may reasonably require from time to time in amounts and for perils against which a prudent *Contractor* would protect itself in similar circumstances.

11.1.9 ***(add article 11.1.9 as follows)***

1. It shall be the duty of the *Contractor* to fully comply with the terms and conditions of the Liability Insurance coverage, including, without limiting the generality of the foregoing, the requirement to promptly report claims to the Insurer and BC Hydro.
2. The *Contractor* shall also promptly notify the *Consultant* of all such claims in writing.
3. If a claim is settled, the *Contractor* shall thereupon provide the *Consultant* with a copy of the Claimant's Release.
4. If a claim is rejected, the *Consultant* shall be notified at the time of rejection.
5. The *Consultant* shall be provided full information as to such claims at all times as the *Consultant* may require and in any event should 30 days elapse after the claim has been received by the *Contractor* and the *Contractor* is not able to report settlement or rejection of the claim, the *Contractor* will provide a full report to the *Consultant* as to the status of and steps being taken with respect to the claim.

11.1.10 ***(add article 11.1.10 as follows)***

All forms of insurance to be endorsed to provide the Owner with not less than thirty (30) days written notice in advance of any cancellation, change or amendment restriction coverage. Prior to the commencement of any work under this *Contract* the *Contractor* shall file with the *Owner*, to the attention of the *Owner*, Certificates evidencing full compliance with the above clauses, in accordance with the prescribed Certificate which is located after the "Tender Form" in the documents.

11.1.11 ***(add new article 11.1.11 as follows)***

The *Contractor* shall ensure the following are additional named insured under this contract:

- The District of Sooke
- Stantec Consulting Ltd.
- British Columbia Hydro and Power Authority

GC 11.2 CONTRACT SECURITY

11.2.1 ***(delete and replace article 11.2.1 as follows)***
The *Contractor*, together with a surety company approved by the Owner and authorised by law to carry on business in the Province of BC, shall furnish a 50% Labour and Materials Payment Bond to the Owner.

11.2.2 ***(delete and replace article 11.2.2 as follows)***
The *Contractor*, together with a surety company, approved by the *Owner* and authorised by law to carry on business in the Province of BC, shall furnish a Performance Bond to the *Owner* using CCDC Document(s) 221 in the amount of 50% of the Contract price.

11.2.3 ***(add new article 11.2.3 as follows)***
within 10 days of the issue of the Certificate of Substantial Performance deliver to the Owner, a Maintenance Period Financial Security in the form of cash or a clean, irrevocable Letter of Credit in a form acceptable to the Owner in the amount of 2.5% of the Contract Price, issued by a major Canadian chartered bank which has a branch in Victoria, payable to the Owner within the Maintenance Period.

Part 12 INDEMNIFICATION, WAIVERS OF CLAIMS AND WARRANTY

GC 12.1 INDEMNIFICATION

12.1.1 ***(delete and replace article 12.1.1. as follows)***
The *Contractor* shall release, indemnify and save harmless the *Owner* and its elected and appointed officers, employees, agents and the *Consultant* from and against all claims, actions, costs, expenses, judgements, damages, fines and fees of whatever kind, including solicitors fees on solicitor and own client basis, which the *Owner* or any other person may have or incur and which arises out of or in connection with any act or omission or alleged act or omission of the *Contractor*, its agents, employees or *Subcontractors* in the execution of the *Work* and other wise in the performance of or failure to perform the *Contract*.

12.1.2 **(delete article 12.1.2 in its entirety)**

GC 12.2 WAIVER OF CLAIMS

(delete article 12.2 in its entirety)

GC 12.3 WARRANTY

12.3.7 ***(add article 12.3.7 as follows)***
Any defective item of equipment necessitating substantial repairs or replacement within the Warranty Period shall be subject to a further Warranty Period of 12 months from the time of repairing or replacement of same. The cost associated with the extended warranty shall be borne by the *Contractor*.

12.3.8 ***(add new article 12.3.8 as follows)***

The *Owner* is authorized to make repairs to defects or deficiencies if, ten days after giving written notice, the *Contractor* has failed to make or undertake with due diligence the required repairs. However, in the case of emergency where, in the opinion of the *Owner*, delay is not reasonable, repairs may be made without notice being sent to the *Contractor.* All expenses incurred by the *Owner* in connection with repairs made pursuant to GC 12.3 shall be paid by the *Contractor* and may be deducted from the Maintenance Security, or other holdbacks. The *Contractor* shall promptly pay any shortfall.

SUPPLEMENTARY SPECIFICATIONS

Contract: **WWTP UPGRADE 2020**

Supplementary Specifications

1.1 The following Supplementary Specifications are incorporated into and form part of the CCDC 2 Stipulated Price Contract.

Part 1 General

1.1 SECTION INCLUDES

.1 General information for requirements for connection to existing system.

1.2 CONTRACTOR'S WORK SEQUENCING PLAN

.1 Coordinate the Work of this Work Package to avoid interference with the existing dewatering equipment. Contractor is to provide a detailed tie-in and work sequencing plan within 2 weeks of project award.

.2 The connection and Work sequencing plan needs to address all aspects of dewatering equipment requirements when connecting to the existing system, commissioning, and handover. Once submitted in draft, the plan will be reviewed by The District and Engineer, and if required the Contractor will revise the plan to meet District requirements.

.3 Scheduling of any connections to existing system is defined in clause 1.4. The allowable shut down periods defined include for all the time required to take the facilities out of service, drain, complete all upgrade works, start-up, and commissioning.

.4 A minimum of two (2) weeks' notice is required by the Contractor to The District for any connection requirements that would otherwise impact normal operations of the WWTP.

.5 Any temporary works required for isolation are the responsibility of the Contractor including supply, installation, and removal activities.

.6 Any scaffolding required is the responsibility of the Contractor including supply, installation, and removal activities.

1.3 CONSTRUCTION / OPERATION WORK SEQUENCE DESCRIPTION

.1 This Specification Section provides general construction / operation Work sequences. They are provided to assist the Contractor to perform construction activities concurrent with activities by District staff within the Work limits and within the existing facilities. The Contractor may propose other Work sequences for acceptance by the Engineer. The Engineer reserves the right to reject any proposed Work sequence by the Contractor.

.2 General Construction Sequence:

.1 The responsibility for planning the sequence of the Work lies with the Contractor. Submit the sequence of the Work to The District and

Engineer for approval including coordinating tie-ins and shutdowns of normally operating Systems.

.2 Ensure that all existing infrastructure, equipment, piping, etc. is well protected during the Work.

.3 The Work, as defined herein, will take place at The District's WWTP facilities, and will need to remain operational throughout construction.

.4 Coordinate time of year and duration of any existing equipment affected by the Work or tie-in of the Work. Refer to clause 1.4 for further detail of the facilities tie-in requirements and the Contractor's work sequences plan as defined in clause 1.2.

.5 Supply all materials required for the construction work. Organize delivery, handling, and storage of all of materials, including pre-selected equipment as well as inspection and acceptance of all purchased materials' responsibility at the Site in writing. Any defective or damaged materials should be noted at that time with the details forwarded to the Engineer.

1.4 WORK SEQUENCING AND CONNECTION LIMITATIONS

.1 Uninterrupted treatment of wastewater at WWTP must always be maintained during construction with exceptions of approved shutdowns.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section of the Specification forms part of the Contract Documents, and is to be read, interpreted and coordinated with all other parts.

.1 Payment will be made based on the Lump Sum Prices in Appendix 1 – Summarized Schedule of Quantities and Prices in the Form of Tender and in accordance with the General and Supplementary General Conditions.

.2 Costs for Work and material not expressly listed in the Form of Tender Appendix 1 but included in the Drawings and/or Specifications by either direct mention or implication, shall be included with items to which they pertain most closely.

.3 The prices tendered for supply and installation of materials shall be full compensation of labour, materials, equipment, transportation, testing, and commissioning with all other work subsidiary and incidental thereto for which separate payment is not provided elsewhere.

.2 All payment items are inclusive of labour, material and equipment required to complete the Work.

.4 The method of measurement of the quantities for payment and the basis for payment will be in accordance with the following items of this Section. All measurements will be done by the Engineer using generally accepted methods of field survey.

.5 The items mentioned in this Section refer to the items so numbered in the Tender Price Breakdown.

.6 Descriptions contained in the payment clauses provide a general description of the tasks. They are not meant to limit the Work.

.7 Quantities stated in the Schedule of Quantities and Prices are given for the purpose of providing a uniform basis for the comparison of tenders. Actual quantities for items listed in the Schedule will only be made on the quantities determined by field measurement. The Contractor agrees that he will have no basis for revising the unit prices(s) should actual quantities vary 15% from those stated herein.

1.2 APPLICATIONS FOR PAYMENT

.1 Refer to Part 5 Payment – General Conditions (CCDC 2), and the Supplementary General Conditions.

.2 The Contractor shall use standard forms for submission of progress claims in the format agreed prior to the end of each month of Work.

.3 Show previous amount claimed and the amount claimed for the period ending. Show percentage of Work completed to date and holdback retained.

1.3 CHANGES IN THE WORK

.1 Refer to Part 6 Changes in the Work – General Conditions (CCDC 2), and Supplementary General Conditions.

.2 Changes to the work will be defined as below and be documented using the following forms:

.1 **Field Order** – Will be used when an instruction is given to the Contractor in the field, which may result in an adjustment to the Contract Price. A Field Order signed by the Engineer and the Owner is authorization to proceed with the Work on a Lump Sum, Unit Price or Force Account/Time and Material basis as stipulated on the Field Order form. Extra work shall not commence until the Contractor receives a copy of the Field Order signed by the Owner and the Engineer.

.2 **Field Memo** – Will be issued by the Engineer and be used as an instruction in situations where the change is not anticipated to result in an adjustment to the Contract Price.

.3 **Change Order** – Will be used for additions or deletions to the Work which originate in the form of revisions to Drawings and Specifications, and which may result in a change to the Contract Price. A Change Order signed by the Engineer and the Owner is authorization to proceed with the Work as stipulated in the Change Order. Extra work shall not commence until the Contractor receives a copy of the Change Order signed by the Owner and Engineer.

.3 Contemplated Changes in the Work

.1 Where a change in the Work is contemplated, the Engineer will give the Contractor written notice advising the Contractor of a contemplated change in the Work. Such notice requires that the Contractor submit either a lump sum quotation or an estimate based on unit prices and quantities, or labour and equipment rates, to the Engineer within the time specified on the form. **Such notice is for information only and is not an instruction to execute changes, or to stop Work in progress.** The Contractor's quotation shall:

.1 Refer to the contemplated change order letter.

.2 Be set out in sufficient detail acceptable to the Engineer.

.3 Indicate the methodology and resources that the Contractor shall use to perform the extra work.

.4 Indicate the cost or credit to complete the changes in the work.

.5 Indicate the schedule to perform the changes in the work; and indicate the impact on the overall project schedule.

.6 Indicate any incremental cost impact included in quotation to maintain the Completion Date.

.7 Indicate that quotation will remain open for acceptance by the Owner for thirty (30) days; and

.8 Submit all required back-up documents.

.2 The Engineer will review the Contractor's quotations for contemplated changes in the Work to determine whether the quotation is acceptable, requires resubmittal or should be rejected. Support quotation with additional substantiating data if requested by the Engineer.

.3 When the quotation has been evaluated and is deemed acceptable to the Engineer, the Engineer will prepare and complete a Change Order entering the acceptable quotation adjustments to the Contract Price and Completion Date for the Owner's signature. Once the Change Order is signed and fully executed by the Owner, it will then be forwarded to the Contractor for signature. The Change Order, signed by the Owner, records, and authorizes the Contractor to proceed with the Work.

.4 Methods for Valuing and Evaluating Changes on the Work

.1 Lump Sum Change Orders and Field Orders

.1 The content of Change Orders or Field Orders will be based on a prior quotation from the Contractor and agreed to by the Engineer and the Owner.

.2 The Contractor shall submit all necessary backup and the quotation shall be broken down as much as required by the Engineer.

.2 Unit Price Change Orders and Field Orders

.1 The content of Change Orders or Field Orders will be based on either prior agreed quantities or a survey of completed Work.

.2 The amounts of unit prices shall be those quoted in the Schedules to the Contract.

.3 When quantities can be determined prior to start of Work, the Engineer will prepare and complete a Change Order or Field Order describing the Work and entering the agreed confirmed unit prices, total quantities and total cost adjustments to the Contract Price and the construction schedule, for the Owner's signature. Once the Change Order or Field Order is signed and fully executed by the Owner, it will then be forwarded to the Contractor for signature. The Change Order, signed by the Owner, records, and authorizes the Contractor to proceed with the Work.

.4 When quantities **cannot be determined** prior to start of Work, the Engineer will assign to the Contractor a Field Order signed by the Owner agreeing and authorizing the described Work to proceed immediately on the basis of the unit prices and an estimate

mutually agreed upon. Upon completion of the changes involved, the Engineer will complete the Field Order entering the final total cost for the Work based on agreed confirmed unit prices and actual measured quantities support data submitted for the Owner's signature to adjust the Contract Price and Completion Date as applicable.

.3 Force Account/Time and Material Change Orders and Field Orders

.1 When a change in the Work cannot be agreed upon by the Lump Sum and Unit Price methods, the Engineer may authorize the Work to be carried out on a Force Account/Time and Material basis.

.2 The Contractor shall provide to the Owner at the onset of the project a table of labour and equipment rates to be used to assess the cost of performing changes in the Work.

.3 The Engineer will provide the Contractor with a Field Order, signed by the Owner agreeing and authorizing the described extra work to proceed immediately on a Force Account/Time and Material basis as reviewed on the Work Site.

.4 The Contractor shall support claims for changes determined by this method via numbered Daily Time Sheets (DTS) submitted the day following the Work with dates and times the Work was performed and by whom; time record, summary of hours worked and hourly rates paid; receipts and invoices for equipment used, listing dates and times of use; materials and products used, listings quantities; subcontracts.

.5 Submit claims on standard form.

.6 Upon completion of the changes, the Engineer will complete the Field Order entering the final approved total cost for the extra work involved, based on agreed confirmed time and material support data, invoices, time sheets and records submitted for the Owner's signature to adjust the Contract Price and Completion Date as applicable.

.7 The percentage mark-up permitted for changes in the Work done on a Force Account basis is specified in the General Conditions.

.4 Quotations for changes in the Work shall show credits for work deleted from the Contract because of the change in the Work, if applicable.

.5 The mark-up on each change shall be applied to the net difference between credits and extras except in the case where the change results in a net credit to the Contract Price, in which case the Contractor is not entitled to charge mark-up on the net credit.

.6 Any dispute arising under this Section shall be governed by Part 8 Dispute Resolution – General Conditions (CCDC 2).

Part 2 Products

Not applicable.

Part 3 Execution

3.1 DIVISION 0 – CONTRACT REQUIREMENTS

.1 Item 1.1 – Bonding and Insurance

.1 This item shall include all costs for bonds, insurance, permits and licenses necessary for the Work. Payment is subject to the submission and approval of contractually required bonds, insurance, permits and licenses.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

3.2 DIVISION 1 – GENERAL REQUIREMENTS

.1 Item 2.1 – Mobilization and Demobilization

.1 Mobilization shall include all costs associated with moving personnel, materials, and equipment to the site, setting up temporary facilities and all preparation for performing the Work.

.2 Demobilization shall include all costs associated with removal of all personnel, materials and equipment, and cleanup of the site.

.3 The cost for mobilization and demobilization shall not exceed 2% of the Total Tender Price.

.4 Payment will be made as follows:

.1 60% of the lump sum price will be included in the first progress payment certificate.

.2 40% of the lump sum price will be included in the final progress payment certificate.

.2 Item 2.2 – Startup, Commissioning and Training

.1 This item shall include all costs associated with start-up and commissioning of the Work pursuant to Section 01 66 20 – Commissioning and Performance Testing, Section 01 66 40 – Training and other relevant Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

.3 Item 2.3 – O&M Manuals and Record Drawings

.1 This item shall include all costs associated with the preparation and submission of Operation and Maintenance (O&M) Manuals and Contractor red-line (“As-built”) Drawings.

.2 Payment will be made on receipt and acceptance of final O&M Manuals and Record Drawings from the Contractor and Equipment Manufacturers.

3.3 DIVISION 3 – CONCRETE

.1 Item 3 – Concrete

.1 This item shall include all costs associated with concrete works including construction of pedestals, housekeeping pads, and slabs as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

3.4 DIVISION 5 – METALS

.1 Item 4 – Metals

.1 This item shall include all costs associated with metal items including handrails, guardrails, grating, checker plate, ladders, hatches, structural steel framework, beams, pipe and duct supports, and other miscellaneous metals not otherwise identified, as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

3.5 DIVISION 22 – PLUMBING

.1 Item 5 – Plumbing

.1 This item shall include all costs associated with the supply and installation of plumbing, fittings, valves, fixtures, and all appurtenances as per the Drawings and Specifications required to complete the Work.

.2 Payment will be made on the percentage complete applied to the lump sum price.

3.6 DIVISION 25 – INTEGRATED AUTOMATION

.1 Item 6.1 – SCADA PLC Programming and Integration

.1 This item shall include all costs associated with the SCADA, PLC and HMI programming and integration required to complete the Work as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

3.7 DIVISION 26 – ELECTRICAL

.1 Item 7.1 – Electrical Equipment and Wiring

.1 This item shall include all costs associated with the supply and installation of the power, control and instrumentation appurtenances and ancillary items as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

.2 Item 7.2 – Commissioning Support

.1 This item shall include all costs associated with the support of commissioning all systems installed as per the Drawings and Specifications. This includes the vendor panels supplied as free issue and as part of the contract, including existing equipment that is re-used (flow meter, centrifuge #1, as an example).

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

.3 Item 7.3 – Other Electrical

.1 This item shall include all costs associated with the supply and installation of other electrical items and appurtenances, not otherwise identified, as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

3.8 DIVISION 40 – PROCESS INTEGRATION

.1 Item 8.1 – Process Piping and Valves

.1 This item shall include all costs associated with the supply and installation of process piping, fittings, valves, and all appurtenances as per the Drawings and Specifications required to complete the Work.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

.2 Item 8.2 – Other Process Appurtenances

.1 This item shall include all costs associated with the supply and installation of other process items and appurtenances, not otherwise identified, as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price tendered.

3.9 DIVISION 43 – PROCESS PUMPS

.1 Item 9.1 – Dewatering Centrifuge Feed Pumps

.1 This item shall include all costs associated with the supply, installation and commissioning of the dewatering centrifuge feed pumps including all appurtenances to complete the Work as per the Drawings and Specifications required.

.2 Application for payment shall be on the following basis:

.1 Eighty percent (80%) of the lump sum price tendered for this item for complete installation subject to monthly progress payments

.2 Twenty percent (20%) of the lump sum price upon successful performance testing pursuant to Section 01 66 20 – Commissioning and Performance Testing.

3.10 DIVISION 46 – DEWATERING EQUIPMENT

.1 Item 10.1 – Dewatering Centrifuge

.1 This item shall include all costs associated with the supply, installation and commissioning of the dewatering centrifuge including all appurtenances to complete the Work as per the Drawings and Specifications required.

.2 Application for payment shall be on the following basis:

.1 Eighty percent (80%) of the lump sum price tendered for this item for complete installation subject to monthly progress payments

.2 Twenty percent (20%) of the lump sum price upon successful performance testing pursuant to Section 01 66 20 – Commissioning and Performance Testing.

.2 Item 10.2 – Polymer System

.1 This item shall include all costs associated with the supply, installation and commissioning of the polymer system including all appurtenances to complete the Work as per the Drawings and Specifications required.

.2 Application for payment shall be on the following basis:

.1 Eighty percent (80%) of the lump sum price tendered for this item for complete installation subject to monthly progress payments

.2 Twenty percent (20%) of the lump sum price upon successful performance testing pursuant to Section 01 66 20 – Commissioning and Performance Testing.

.3 Item 10.3 – Conveyor System

.1 This item shall include all costs associated with the supply, installation and commissioning of the conveyor system including all appurtenances to complete the Work as per the Drawings and Specifications required.

.2 Application for payment shall be on the following basis:

.1 Eighty percent (80%) of the lump sum price tendered for this item for complete installation subject to monthly progress payments

.2 Twenty percent (20%) of the lump sum price upon successful performance testing pursuant to Section 01 66 20 – Commissioning and Performance Testing.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Contract Administrator Submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

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

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated, and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator’s review.

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 14 days for Contract Administrator's review of each submission.

.5 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.6 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.9 After Contract Administrator's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

.11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Report signed by authorized official of testing laboratory that material, product, or system identical to material, product, or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copies of manufacturers’ instructions for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Pre-printed material describing installation of product, system, or material, including special notices and Material Safety Data Sheets concerning impedances, hazards, and safety precautions.

.15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.

.17 Delete information not applicable to project.

.18 Supplement standard information to provide details applicable to project.

.19 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, reviewed electronic copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.20 The review of shop drawings by Contract Administrator is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that Contract Administrator approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Contract Administrator's site office.

.3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.5 DIGITAL COPY

.1 Provide digital copies in PDF format of all reviewed submittals.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Engineer will carry out Quality Assurance activities including but not limited to inspection, testing, and review of test results and reports during the construction period of the project.

.2 Allow Engineer access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Engineer's instructions, or law of Place of Work.

.4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.5 Engineer will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Engineer shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Engineer for purpose of inspecting and/or testing portions of Work required for Engineer's Quality Assurance activities. Cost of such services will be borne by Engineer.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Engineer at no cost to Engineer. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

.1 Notify appropriate agency and Engineer in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Engineer as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Engineer it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Engineer will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Engineer.

1.6 REPORTS

.1 Submit copies of inspection and test reports in PDF format to Engineer.

.2 Provide copies to subcontractor of work being inspected or tested and/or manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Engineer and may be authorized as recoverable.

1.8 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to Engineer.

.3 Prepare mock-ups for Engineer's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Engineer will assist in preparing schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to Engineer.

.7 Mock-ups may remain as part of Work if approved by Engineer.

1.9 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical and electrical equipment and systems.

.2 Refer to appropriate section for definitive requirements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION / REMOVAL

.1 Contractor shall provide temporary utilities as necessary to execute the Work expeditiously.

.2 Contractor shall provide temporary utilities as necessary to be self contained, self sufficient with no dependence existing facilities.

.3 Contractor shall make necessary applications to authorities having jurisdiction, obtain required permits, and pay all fees and related charges.

.4 Contractor shall remove from Site all temporary utilities after use.

.5 Contractor shall restore Site to clean, sanitary condition.

1.2 TEMPORARY SERVICES

.1 Protect all temporary services from damage, and repair services damaged during the Work, if any, at no cost to The District.

.2 When performing tie-ins to temporary services or utilities, carry out work at times directed by local governing authorities, with a minimum amount of disturbance to the Work.

.3 Protect, relocate or maintain temporary active services as required. When inactive services are encountered, cap off in a manner approved by local governing authorities having jurisdiction.

1.3 SANITARY FACILITIES

.1 Provide sanitary facilities for workforce in accordance with governing regulations and ordinances. **Under no circumstances shall the contractor use client owned facilities.**

.2 Post notices and take such precautions as required by local health authorities.

.3 Keep Work Site and premises in sanitary condition.

.4 Disinfect facilities frequently.

.5 Dispose of sanitary wastes, in accordance with the applicable regulations, and subject to approval of the Engineer.

.6 Provide all sanitary supplies required for use by the workforce within the Work Site.

1.4 POWER

.1 Temporary power will be available at the site.

1.5 TELEPHONE AND INTERNET

.1 Provide and pay for temporary telephones and Internet connections as necessary.

1.6 POTABLE WATER

.1 No potable water is available at the Work Site. Contractor to pay for potable water as required to complete the Work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary Access Roads.

.2 Temporary Parking Areas.

.3 Traffic Control.

1.2 TEMPORARY PARKING AREAS

.1 Parking will be permitted on site provided it does not impact the performance of the work and ongoing maintenance requirements of the District.

1.3 TRAFFIC CONTROL

.1 Regulate Work in accordance with Ministry of Transportation and Infrastructure (MoTI) when working on West Coast Road.

.2 Comply with requirements of the “Traffic Control Manual for Work on Roadways”, published by the MoTI, for regulation of vehicle and pedestrian traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

.3 When working on travelled way:

- .1 Place equipment in such position as to present a minimum of interference and hazard to the travelling public.
- .2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
- .3 Do not leave equipment on travelled way overnight.
- .4 Do not close any lanes of road or highway without prior approval of the Contract Administrator. Before re-routing traffic erect suitable signs and devices as approved by the Contract Administrator. Provide sufficient crushed gravel to ensure a smooth riding surface during work.
- .5 Keep travelled way well graded, free of potholes and of sufficient width that required number of lanes of traffic may pass.
- .6 When directed by Contract Administrator, provide well graded, gravelled detours or temporary roads to facilitate passage of traffic around restricted construction area.
- .7 Traffic Control Information and Warning Devices:
  - .1 Meet with Contract Administrator prior to commencement of work to prepare list of signs and other devices required for project.
  - .2 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work which may require road user response.

.3 Supply and erect signs, delineators, barricades, and other miscellaneous warning devices in accordance with municipal and MoTI requirements.

.8 Control of Traffic Using Flaggers:

.1 Provide flag persons, trained, and properly equipped for the following situations:

.1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through the construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic may have limited visibility.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are readily available.

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

.9 Always provide and maintain two-way traffic on all roads unless written approval is otherwise provided by Contract Administrator.

.10 Comply with MoTI Permit to Construct when working with MoTI property.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, shafts, and other openings.

.2 Close off floor areas where walls are not finished, seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.5 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.6 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.7 TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Engineer, locations, and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with local requirements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.2 REGULATORY CRITERIA

.1 General:

.1 Comply with Federal, Provincial, District of Sooke Policies and Procedures listed below.

.2 Federal Regulations

.1 *Fisheries Act*.
.2 *Heritage Act*
.3 Marine Mammal Regulations.
.4 *Migratory Birds Convention Act.*
.5 Migratory Birds Regulations.
.6 *Species at Risk Act.*
.7 *Navigation Protection Act.*
.8 Navigable Waters Works Regulations.
.9 *Canadian Environmental Assessment Act* (CEAA).
.10 *Canadian Environmental Protection Act* (CEPA).

.3 Provincial Regulations

.1 *BC Environmental Management Act* (EMA).
.2 BC Contaminated Sites Regulation (CSR).
.3 BC Water Quality Guidelines (BCWQG).
.4 *BC Wildlife Act* (1996).
.5 *BC Fish Protection Act* (1997).

.4 Municipal Regulations

.1 District of Sooke Municipal Bylaws.

.5 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.

1.3 ENVIRONMENTAL MANAGEMENT PLAN

.1 Contractor to provide an Environmental Management Plan in accordance with this section and MMCD Platinum Requirements.

1.4 ENVIRONMENTAL INCIDENTS

.1 All environmental incidents must be reported immediately to the Contract Administrator.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 An approved Environmental Protection Plan is required prior to commencing construction activities or delivery of materials to site.

.3 Ensure Environmental Protection Plans include comprehensive overview of known or potential environmental issues to be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.5 Within 10 days of Notice of Award, the Contractor is required to submit a CEMP to the Owner for Review.

1.6 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.7 DRAINAGE

.1 Provide Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Ensure plan includes monitoring and reporting requirements to assure that control measures follow erosion and sediment control plan, Federal, Provincial, and Municipal laws, and regulations.

.2 Provide temporary watertight drainage detention structures and pumping as necessary to keep excavations and site free from accumulated water.

.3 Control disposal or run-off of water containing suspended materials or other harmful substances in accordance with District bylaws, CVRD bylaws.

1.8 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Wrap in burlap, trees, and shrubs adjacent to construction work, storage areas trucking lanes and encase with protective wood framework from grade level 2 metres.

.3 Protect roots of designated trees to dripline during excavation and site grading disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Re-seed disturbed areas of bare soil as soon as possible post-construction.

.5 Restrict tree removal to areas indicated or designated.

1.9 POLLUTION CONTROL

.1 Provide and maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures as directed.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Vehicles shall be shut off when not in use. No vehicle idling on-site.

.6 Maintain supply of spill kits adequate for all material that could potentially spill on site during execution of work. Ensure that workers are trained in their use.

1.10 NOISE

.1 Work activities shall be limited to normal business hours to minimize noise disturbance outside of those hours.

.2 Equipment and machinery shall be properly maintained to minimize unnecessary noise pollution.

.3 Work shall be completed in accordance with local municipal noise bylaws.

1.11 SOIL MANAGEMENT

.1 Contaminated soil removed from the site shall be transported and disposed in accordance with all applicable legislation.

.2 Stockpiled materials shall be covered with 6-mil poly during precipitation events and at the end of each workday.

.3 As a precaution against the potential transfer of contamination, stockpiled excavated soil shall be placed on impermeable surfaces, and covered securely with impermeable polyethylene sheeting when not in use.

.4 The Contractor shall minimize cross-contamination and mixing of individual stockpiles. Individual stockpiles are to be no larger than 50 m^3 in size.

.5 Contractor shall provide suitable equipment at the stockpile site to pile soil into individual stockpiles and for site maintenance.

.6 All stockpiled areas shall be reinstated to original condition or better.

1.12 ARCHAEOLOGICAL RESOURCES

.1 For the purposes of this Contract Archaeological Significant Materials / Archaeological Objects are defined as any material remains, including but not limited to architecture, artifacts, biofacts, human remains, and anthropogenic landscapes, or any other pre and post-contact objects deemed significant by the Contract Administrator, that may be discovered above or below ground. Examples include bones, fire broken rock, arrow heads, jewelry, coins, and naval artifacts.

.2 If archaeological deposits are discovered in the construction zone, stop work immediately and notify the Contract Administrator.

.3 Archaeologically significant material, if found, remains the property of the Crown and shall not be removed from the site.

.4 Contractor to provide environmental incident reports in the event of a discharge of a harmful or dangerous material to the environment to the Contract Administrator no less than 3 days following the incident.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 REPORTING

.1 Contractor is required to submit weekly Environmental Monitoring Reports to the Contract Administrator no later than 1 week after the reporting period.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether products or systems are in conformance with applicable standards, Engineer reserves the right to have such products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be borne by Engineer in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment, and articles incorporated in Work shall be new, not damaged, or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use products and items that contain recycled and recovered materials.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Engineer based upon requirements of Contract Documents.

.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for like item throughout building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Engineer of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Engineer at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Engineer reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Engineer.

.9 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Engineer will be paid for by Engineer. Unload, handle and store such products.

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers. Manufacturer’s technical representative must be present on site when installation or erection of their product is carried out.

.2 Notify Engineer in writing, of conflicts between specifications and manufacturer's instructions, so that Engineer will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Engineer to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Engineer if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Engineer reserves the right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Engineer, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves, and accessories.

1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls, and ceilings, except where indicated otherwise.

.2 Before installation inform Engineer if there is interference. Install as directed by Engineer.

1.10 REMEDIAL WORK

.1 Refer to Section 01 73 00 - Execution.

.2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Engineer of conflicting installation. Install as directed.

1.12 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill, or sleeve load bearing structural member, unless specifically indicated without written approval of Engineer.

1.15 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities and Engineer, with minimum of disturbance to Work, adjacent properties, and pedestrian and vehicular traffic.

.2 Protect, relocate, or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section describes general requirements relating to equipment delivery, equipment storage, handling and protection, equipment installation training, equipment installation, equipment Demonstration, and System Operational Testing.

.2 Details specific to the Commissioning, Performance Testing (PT) and/or Guaranteed Performance Testing (GPT) are provided in Section 01 66 20.

1.2 DEFINITIONS

.1 **System**: A System is defined as the equipment, piping, controls, ancillary devices, electrical power, etc. which together perform a specific function at the Facility.

.2 **Facility:** The Facility is defined as the Systems, which together perform the intended functions of the Plant expansion.

.3 **Supplier (or Manufacturer):** The Supplier (also referred to as the Manufacturer) is the person, partnership, or corporation responsible for the fabrication of equipment provided for the completion of the work.

.4 **Supplier's (or Manufacturer's) Representative**: Supplier's Representative (also referred to as Manufacturer's Representative) is a trained technical service person empowered by the Supplier to provide:

.1 Installation training.

.2 Witnessing of equipment installation.

.3 Assistance in equipment/System Demonstration and System Operational Testing and Commissioning.

.4 Execution of Performance and/or Guaranteed Performance Testing, where specified.

.5 **Demonstration Testing:** One (1) hour Major Equipment testing to demonstrate the operation of the equipment and any ancillary services that are the responsibility of the Supplier to provide. The equipment will be turned on and off as per manual input and control signals.

.6 **System Operational Testing**: Seven (7) days of successful operation (with the last three (3) days to be consecutive) demonstrating that the process mechanical, structural, electrical and instrumentation and control elements related to the process System have been installed as intended and operate over the range of design conditions specified. The operational test will prove that the equipment is able to comply with specific design requirements listed in the

Technical Specifications and that controls function properly and are fully automated as detailed in the technical specifications.

.7 **Hand Over:** For the purpose of this Work Package, Hand Over will occur on receipt of all completed **"Certificate of Satisfactory System Operational Testing" (Form 103)** documentation, at which point operation of the Facility will be transferred from the Contractor to The District, under the direction of the Commissioning Team (refer to Section 01 66 20). Care of the Facility will remain the responsibility of the Contractor until Substantial Performance award.

.8 **Substantial Performance:** Note that all **Forms 104 "Certificate of Satisfactory Commissioning"** are required before the Work is substantially performed.

.9 **Critical Failure:** A Critical Failure shall be deemed as one that prohibits the process from functioning successfully for an eight (8) hour period, or one that requires the use of available standby equipment, or one that creates a safety hazard

1.3 EXPERTISE AND RESPONSIBILITY

.1 The Engineer recognizes the expertise of the Supplier.

.2 Should the Engineer issue an Addendum, Notice of Proposed Change, Field Order or Change Order to change the work, which would, in the opinion of the Supplier, compromise the success or safety of the Work, then it must be incumbent on the Contractor to notify in writing the Engineer to this effect within three (3) days upon receipt.

1.4 EQUIPMENT DELIVERY

.1 Arrange for delivery of all equipment to the Work Site including freight, duty, insurance, and all covering charges on the delivery scheduled within the time frame stated in the Work Package documents, and in coordination with the Contractor. At that point, the Contractor will assume responsibility for taking delivery, unloading and storage of the equipment. Written acceptance of receipt, at delivery, by the Contractor shall constitute "Delivery to Site". A representative from the Supplier, Contractor and Engineer shall attend time of delivery.

.2 Investigate thoroughly and follow all precautions to be taken in the unloading of equipment and its subsequent storage.

.3 The Supplier will attend the delivery Site to check the delivery and to examine the Major Equipment for damage or loss and inspect the Contractor's storage facilities for the equipment supplied for compliance with the Supplier's recommendations. Suppliers will maintain an inventory of all equipment supplied and delivered to the Contractor.

.4 In conjunction with the Contractor, the Supplier will examine all crates and packages on delivery and compare them with the packing lists. Ensure both the

Supplier and Contractor inform the Engineer and the carrier in writing of any visible damage, missing items, or defects. Arrange to replace forthwith items not delivered or delivered defective or damaged to the Site. The Supplier will be held responsible for damage during shipping, and any costs accrued in replacing/repairing equipment.

.5 The Supplier will give notice to the Contractor (with a copy to the Engineer) ten (10) days before delivery to allow arrangements for receipt and inspection. Contractor to arrange for deliveries and inspection/unloading during normal working hours. When the Supplier and Contractor are satisfied that the equipment has been delivered in its entirety without damage, complete the **"Certificate of Equipment Delivery" (Form 100)** attached to this Specification. Deliver the completed form to the Engineer.

.6 Prepare one (1) copy of **Form 100** for each piece of Major Equipment and for each delivery.

1.5 EQUIPMENT DELIVERY SCHEDULE

.1 Present the initial equipment procurement and delivery schedule (single or multiple shipments) within a timeframe identified in the Work Package documents. These documents define all equipment to be procured, the confirmed Supplier delivery date, and the scheduled installation date.

.2 Do not have the equipment delivered to Site until suitable storage facilities have been made available by the Contractor, and the Contractor and Supplier have agreed upon a delivery date

1.6 STORAGE, HANDLING, AND PROTECTION OF PRODUCTS

.1 Ensure that equipment Suppliers and Manufacturers adequately pack and crate each component to provide protection during transport, handling, and storage. No item shall be shipped loose or in such a way as to be adversely affected by weather conditions, pilferage, normal transit hazards or other reasonably anticipated shipping hazards.

.2 Ensure that equipment Suppliers and Manufacturers:

- .1 Protect polished and machined metal surfaces from corrosion and damage during shipment and storage
- .2 Protect threaded connections with threaded plugs or caps
- .3 Protect open plain end pipes with caps.
- .4 Specially pack electrical equipment and control panels to prevent scratching; ingress by dirt, moisture, or dust; or damage to insulation
- .5 Cover equipment having exposed bearings and glands to exclude foreign matter.

.3 Off-loading and storage of the equipment at the job site will be the responsibility of the Contractor.

.4 The Contractor is responsible to arrange for storage at the job site as required by the Supplier for sensitive items of equipment. Clearly identify such sensitive items prior to delivery to Site, with clear markings placed on the packages and crates.

.5 Where the equipment is to be stored on Site for longer than one (1) month before installation and Demonstration and Operational Testing, ensure the Supplier instructs Site staff how to undertake the specific storage and maintenance requirements that ensure there is no uneven wear or distortion of equipment component parts.

.6 Products subject to damage from weather are to be stored in weatherproof enclosures.

.7 Contractor is responsible to arrange for heated, covered and humidity-controlled storage at the job Site as required by Suppliers or Manufacturers for sensitive items of equipment.

.8 Ensure the Supplier informs the Contractor in writing on the off-loading, storage and periodic maintenance requirements for the materials and equipment, emphasizing any particular precautions, including any special oils or greases needed, to be taken during the off-loading, storage and pre-start-up periods.

.9 Pack equipment suitable for outside storage to the satisfaction of the Supplier, Contractor, and Engineer. Identify each component with durable labels or tags securely attached to each piece of equipment, crate, container, module, or skid.

.10 Store packaged or bundled products in original and undamaged condition with Manufacturers' or Suppliers' seals and labels intact. Do not remove from packaging or bundling until required in the Work.

1.7 INSTALLATION ASSISTANCE

.1 Supplier shall attend the Site to provide instructions to Site staff in the methods, techniques, precautions, and any other information relevant to the successful installation of the equipment. Make the Site visit before the installation of the equipment commences.

.2 Inform the Engineer, in writing, of the attendance at the Site of the Supplier's Representative for installation training at least fourteen (14) days prior to arrival.

.3 Have the Supplier instruct Site staff in the proper installation of the equipment and provide all necessary installation instructions in writing, copy to the Contractor and Engineer.

.4 Ensure Supplier provides advice and instructions to the Contractor on the installation of the equipment but recognize that responsibility for the detailed supervision of the installation of the equipment and of the workers installing it rests with the Contractor. Notify the Contractor and the Engineer in writing immediately in the event of any disputes with the Contractor concerning installation of the equipment.

.5 For all Major Equipment, when the Supplier is satisfied that the Site staff and Contractor is aware of all installation requirements, certify the same by completing the **"Certificate of Equipment Installation Instructions" (Form 101**) attached to this Specification and ensure the Contractor also signs. To the completed form, attach all written instructions provided by the Supplier or Manufacturer. Provide this certification to the Engineer before leaving the Site.

.6 Do not commence installation of the equipment until the Engineer has advised that he has accepted the completed **Form 101.**

.7 Prepare one copy of **Form 101** for each piece of Major Equipment.

1.8 INSTALLATION

.1 If necessary, or if so, directed by the Engineer during the course of equipment installation, contact the Supplier to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.

.2 If it is found necessary, or if so, directed by the Engineer, arrange for the Supplier to visit the Site to aid and review of procedures during installation.

.3 Prior to completing installation, inform the Supplier and arrange for the attendance at the Site of the Supplier's Representative to verify successful installation.

.4 With the Supplier's Representative, conduct a detailed inspection of the installation including alignment, attached pipe work, wiring and motor starters, electrical connections, controls and instrumentation, rotation direction, running clearances, lubrication, workmanship, satisfactory noise and vibration emissions and all other items as required to ensure successful long term operation of the equipment.

.5 Identify any outstanding deficiencies in the installation and provide a written report to the Engineer and Contractor describing such deficiencies. The Manufacturer's or Supplier's Representative is required to re-inspect the installation after the deficiencies are remedied, at no cost to The District

.6 When the Supplier's Representative accepts the installation, the installer and the Supplier will certify the installation by completing the **"Certificate of Satisfactory Equipment Installation" (Form 102)**, attached to this Specification. To the

completed form, attach any check lists or installation reports provided by the Manufacturer's or Supplier's Representative that exhibits reasonable compliance with the Manufacturer's or Supplier's installation requirements.

.7 Deliver the completed **Form 102** to the Engineer prior to departure of the Supplier's Representative from the Site.

.8 Tag the equipment with a 100 mm by 200 mm card stating "Equipment Checked. Do Not Run." stenciled in large black letters. Sign and date each card.

.9 Prepare one (1) **Form 102** for each piece of Major Equipment.

1.9 DEMONSTRATION AND SYSTEM OPERATIONAL TESTING PLAN

.1 Six (6) months prior to commencing System Operational Testing, the Supplier will assist the Contractor to prepare and submit a draft detailed start-up plan to indicate the schedule and sequence of equipment installation checks and tests required to validate proper operation. The purpose of this test plan is to outline the steps needed to demonstrate that the equipment meets operational requirements, as defined in the Technical Specifications (e.g. pipe pressure testing, electrical loop validation, etc.). The final plan is to be submitted to the Engineer two (2) months prior to commencement of System Operational Testing, incorporating all comments received on the draft copy.

.2 The plan will be prepared by the Contractor with input from Subcontractor(s) and the Supplier.

.3 No equipment testing work can commence until this plan has been reviewed by all parties involved and accepted by the Engineer and The District.

.4 Include the following in the Demonstration and System Operational Testing plan:

.1 Detailed schedule of events, including but not limited to the schedule for completion of testing of all component parts of the System.

.2 Methods for introducing flow required during System Operational Testing.

.3 Methods for disposing of flow required during Operational Testing.

.4 Planned attendance schedule for the Supplier's Representative.

.5 List of personnel who are planned to be in attendance for the Demonstration and System Operational Testing, indicating their qualifications for this Work.

.6 A checklist of all conditions and operating properties that will be tested through the System Operational Testing period including starting, normal stop, emergency stop, modulated operation (if relevant) at various conditions, vibration, alignment, noise, etc. Describe the expected performance/System reaction for each condition.

.7 Contingency plans in the event of a System malfunction.

.8 Drawings and sketches as required, illustrating the planned sequence of events.

.9 List and details for all temporary equipment (pumps, etc.) required to facilitate testing. Supply all temporary equipment not supplied by the Contractor.

.5 The Demonstration and System Operational Testing plans must be reviewed and agreed by the Demonstration and System Operational Testing teams prior to implementation. The District will be the final arbiter of the plan's suitability for purpose.

1.10 DEMONSTRATION AND SYSTEM OPERATIONAL TESTING TEAM

.1 A team led by the Contractor, and including representation from the Supplier, Subcontractor (if required), Engineer, and The District's engineering and operations staff will plan and conduct the Demonstration and System Operational Testing.

.2 The District will have ultimate authority to stop the System Operational Testing effort. The Contractor will coordinate the System Operational Testing with input from the remainder of the Team.

.3 The District will provide staff trained in wastewater treatment plant operation to operate the Facility during the System Operational Testing. During this period, maintenance is the responsibility of the Contractor.

.4 Provide personnel representing the appropriate trades, including mechanical, electrical, control and instrumentation personnel during the Demonstration and System Operational Testing. Ensure that these personnel are skilled, able to expedite any repairs, adjustments, etc. as are required to complete the testing with as few delays as possible.

.5 The Supplier must make available as required, representatives who are experienced in on-site start-up and commissioning of similar equipment.

1.11 DEMONSTRATION AND SYSTEM OPERATIONAL TESTING – GENERAL REQUIREMENTS

.1 The Major Equipment will be subjected to

.1 A one (1) hour Demonstration Test, and

.2 A seven (7) successful day System Operational Test (with the last three (3) days to be consecutive) using clean water or Plant's secondary effluent, wastewater, sludge, or air, depending on the System, and

.3 Commissioning, and

.4 Performance Testing and/or Guaranteed Performance Testing (Section 01 66 20), as required in the Technical Specifications.

.2 The tests will be conducted after installation has been verified and any identified deficiencies have been remedied, training has been provided and operations and maintenance manuals have been reviewed and accepted.

.3 Inform the testing team at least sixty (60) days in advance of the expected date of the Demonstration and System Operational Testing and arrange for the attendance of the Supplier's Representative at Site. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed with the Contractor and testing team.

.4 Have the Supplier conduct all necessary checks to demonstrate that the Major Equipment is properly installed. Alignment, piping connections, electrical connections, sample product, etc. will be checked and if appropriate, code certifications provided. The Supplier will advise the testing team of any further work needed prior to confirming the equipment is ready to run.

.5 All necessary temporary piping, connections, etc. needed to allow the equipment to operate in isolation will be complete. Also, finalize arrangements to have the necessary commodities in place during the test, complete with the planning and physical arrangements necessary for the discharges and allowances for disposal of those discharges.

1.12 EQUIPMENT TRAINING

.1 Refer to Section 01 66 40 – Training for details of training requirements.

Part 2 Products – Not Used

Part 3 Execution

3.1 DEMONSTRATION TESTING

.1 Procedure: Each piece of Major Equipment will be started and operated for one (1) hour. Satisfactorily verify local controls by cycling the equipment through several start-stop operations, modulating output, or some combination. Check operating parameters such as temperature, pressure, voltage, vibration, etc. to ensure that they are within the specified or Supplier's recommended limits, whichever are more stringent.

.2 Should Demonstration Testing reveal any defects under the scope of the Work Package, promptly remedy those defects. After rectification, continue Demonstration Test to the satisfaction of the testing team. Additional costs incurred due to repeated days of failure of testing caused by defects under the scope of the Work Package will be the responsibility of the Contractor.

.3 The District / Engineer reserve the right to request additional testing.

.4 On satisfactory completion of the Demonstration Test, the Major Equipment will be stopped. Recheck all critical parameters such as alignment prior to the seven (7) successful day System Operational Testing (with the last three (3) days to be consecutive).

3.2 PREPARATION FOR SYSTEM OPERATIONAL TESTING

.1 Prior to the System Operational Test, ensure the following:

.1 Clean water or air, depending on the System, is available for System Operational Testing (Contractor must confirm availability of such medium with The District).

.2 All necessary System piping, wiring, control, and other conduit systems have been installed and tested.

.3 Any necessary equipment servicing has been completed

.4 Individual elements of the equipment or controls have been tested prior to the testing of any Systems.

.5 Electrical connections are complete and inspected to the satisfaction of the governing authorities.

.6 Control systems are complete, and the related control software debugged (If any control software malfunction was recognized during System Demonstration Test).

.7 All alarms, safety interlocks and shutdown functions are operational.

.8 All automated, programmed functions are operational, so that no damage could result to the equipment when operated in automatic mode. Control and monitoring of the functions of the equipment will be fully achievable through the SCADA system.

.9 Architectural finishes, heating and ventilation and lighting are substantially complete to provide a safe and comfortable working environment for the testing team during the System Operational Testing process.

.2 Provide the initial charges of oil, grease, and all materials necessary for the System Operational Test all to the satisfaction of the Engineer.

.3 Provide a list of personnel who are planned to be in attendance for the System Operational Test, indicating their qualifications for this Work.

.4 Initial staff training sessions must be completed and **"Certificate of Satisfactory Training" (Form T1)** signed. Refer to Section 01 66 40 for details of training requirements.

.5 Operating and Maintenance Manuals must have been submitted and accepted with **"Equipment Warranties and Guaranteed" (Form OM1)**, **"Certificate of Satisfactory Submission of Equipment Guarantee" (Form OM2)** and **"Certificate of Satisfactory Submission of O&M Manuals" (Form OM3)** signed and all spare parts must be received with "**Certificate of Spare Parts Provision and Documentation" (Form SP1)** signed.

3.3 SEQUENCE

.1 Systems will be tested in a logical manner. Test upstream components first to the degree possible.

.2 The following sequence of events must be followed:

.1 Process Control Narratives must be made available by the Engineer six (6) months prior to System Operational Testing.

.2 Draft Operating and Maintenance Manuals must be available from the Supplier at least three (3) months prior to the System Operational Testing.

.3 Control System tested and fully operational to operate the System through the SCADA system

.4 Start and run System in manual mode.

.5 Turn separate items of equipment to automatic in a planned and logical manner. Ensure that the control system is operating the equipment in a manner which precludes damage of the equipment and which is consistent with the process operating requirements.

.6 Seven (7) days of successful operation (with the last three (3) days to be consecutive) to satisfy the requirements of the System Operational Testing period in accordance with this Section.

3.4 SYSTEM OPERATIONAL TESTING

.1 During the System Operational Testing, the testing team will start, stop, modulate, vary the speed of, and otherwise operate the equipment in the Systems in the facility. The Contractor will have ultimate responsibility of the Systems at this stage. With the Supplier, immediately undertake any remedial measure required to ensure satisfactory operation.

.2 Contractor to provide water, chemicals, temporary power, and any other ancillary services except as indicated, specifically used to conduct System Operational Testing at no additional cost to The District.

.3 Provide any temporary piping, valves, fittings, or related ancillary equipment necessary to conduct testing, all at no additional cost to The District. Take responsibility to ensure that temporary facilities employed are adequate to avoid failure.

.4 The equipment will be re-started and run continuously for seven (7) successful days (with the last three (3) days to be consecutive) as part of the System Operational Test. During the System Operational Test, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the testing team as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

.5 The Facility shall operate successfully for seven (7) days of testing (with the last three (3) days to be consecutive). Minor failures shall not void the testing period. A minor failure is defined as one which does not present a safety hazard, does not impact overall process functioning and can be temporarily overcome using available standby equipment. The last three (3) days of testing shall be re-started if a Critical Failure occurs.

.6 Every effort shall be made to ensure that the System Operational Testing period provides for the full and comprehensive operation of the supplied equipment under all anticipated normal and adverse operating conditions.

.7 It is anticipated that to achieve seven (7) full days of successful operation (with the last three (3) days to be consecutive), the actual elapsed time may be at least twenty (20) days. In the event of dispute whether a day is “successful”, the Engineer will be the final arbiter. The results of the one (1) hour Demonstration Test and the System Operational Test will be submitted to the testing team, documented, and summarized in a format acceptable to the Engineer and The District. The District and the Engineer reserve the right to request additional testing.

.8 Should System Operational Testing reveal any defects under the scope of the Work Package, then promptly rectify those defects and repeat the System Operational Test to the satisfaction of the testing team. Contractor will bear all additional costs incurred by the Contractor, Engineer or The District, due to repeated System Operational Test.

.9 Any problems or deficiencies which occur during the System Operational Testing must be rectified before the signing of **“Certificate of Satisfactory System Operational Testing” (Form 103).**

.10 After System Operational Testing, remove any temporary facilities. Completion of this task will be required before signing of **Form 103**.

3.5 VALIDATION OF SUCCESSFUL TESTING

.1 On successful completion of the Demonstration and System Operational Test, **Form 103** attached to this Specification will be signed by the Supplier, Contractor, Engineer and The District.

.1 **Form 103** will not be issued for a System without successful completion of respective System training **(Form T1)**, submission and acceptance by the Engineer of equipment warranties and guaranteed **(Forms OM1 and OM2)**, , Operations and Maintenance Manuals **(Form OM3)**, and submission of spare parts **(Form SP1)**. Refer to Sections 01 66 40, 01 66 20 and 01 33 00 for details.

.2 Use one copy of **Form 103** for each System.

3.6 SYSTEM OPERATIONAL TESTING ACCEPTANCE

.1 An acceptance meeting will be held at the end of the System Operational Testing to confirm the status of the Facility. This meeting will be called by and coordinated by the testing team and attended by The District, Engineer, Supplier (if necessary, for a specific System), and Contractor. The purpose of the meeting is to review the schedule of any remedial work necessary prior to Commissioning.

CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100

We certify that the equipment listed below has been delivered into the care of the Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
Print Name Signature Date

(Authorized Signing Representative of the Contractor)

_____ _____
Print Name Signature Date

(Authorized Signing Representative of the Supplier or Manufacturer)

_____ _____
Print Name Signature Date

(Authorized Signing Representative of the Engineer)

CERTIFICATE OF EQUIPMENT INSTALLATION INSTRUCTIONS

FORM 101

I have familiarized the Contractor of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Supplier or Manufacturer)

I certify that I have received satisfactory installation instructions from the equipment Manufacturer or Supplier.

_____ _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Contractor)

CERTIFICATE OF SATISFACTORY EQUIPMENT INSTALLATION
FORM 102

I have completed my check and inspections of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Supplier or Manufacturer)

_____ _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Contractor)

CERTIFICATE OF SATISFACTORY SYSTEM OPERATIONAL TESTING
FORM 103

We certify that the Major Equipment listed below has been operated for at least seven (7) successful days (with the last three (3) days to be consecutive) and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The piece of equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____ _____
Print Name Signature Date

(Authorized Signing Representative of the Supplier or Manufacturer)

_____ _____ _____
Print Name Signature Date

(Authorized Signing Representative of the Contractor)

_____ _____ _____
Print Name Signature Date

(Authorized Signing Representative of the Engineer)

I Acknowledge Receipt of the O&M Manuals, training, and spare parts (**OM1, OM2, OM3, T1, and SP1 Forms** complete)

_____ _____ _____
Print Name Signature Date
(Authorized Signing Representative of The District)

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section describes the Contractor's and Supplier's responsibilities for the satisfactory Commissioning, Performance Testing (PT) and/or Guaranteed Performance Testing (GPT) of the Work of this Work Package including process, electrical, mechanical, instrumentation and control and other systems to be supplied. The intent is that the Contractor, and Supplier shall provide on-site technical assistance and supervision to ensure successful equipment operation during the Commissioning period and optimum equipment performance during the PT and/or GPT period.

.2 During the Commissioning, PT and/or GPT periods, the responsibility to operate the Facility will rest with The District (with The District in ultimate control of operating the equipment under all circumstances).

1.2 DEFINITIONS

.1 **System:** A System is defined as the equipment, piping, controls, ancillary devices, electrical power, etc. which together perform a specific function at the Facility.

.2 **Facility:** The Facility is defined as the Systems, which together perform the intended functions of the Plant expansion.

.3 **Commissioning Team:** During the Commissioning and Performance Testing and/or Guaranteed Performance Testing periods, the Contractor will lead a Commissioning Team also comprised of staff from The District, Engineer, Subcontractor(s), and Supplier(s). The Commissioning Team members may be called upon by The District to provide support to remedy equipment problems or provide related services.

.4 **Commissioning:** The successful operation of all Facilities and Systems in accordance with the design requirements for a period of seven (7) successful days to prove compliance with the requirements listed in the Technical Specifications. The last three (3) days of Commissioning must be consecutive and without a Critical Failure.

.5 **Substantial Performance:** Substantial Performance definition includes the definition elsewhere in the Contract documents. Note that the completion of the **Certificate of Satisfactory Commissioning – Phase 1" (Form 104)** pre-requisites is required before the Wok is substantially performed.

.6 Performance Testing (PT) and/or Guaranteed Performance Testing (GPT):

.1 Equipment will be subjected to Performance Testing and/or Guaranteed Performance Testing, where specified in the Technical Specifications.

.2 PT and/or GPT will be conducted pre-Commissioning (concurrent or after completion of **Form 103**) and/or post-Commissioning, as practicable and agreed between the Engineer and the Contractor.

.7 **Hand Over:** For the purpose of this Work Package, Hand Over will occur on receipt of all completed **Form 103** documentations, at which point operation of the Facility will be transferred from the Contractor to The District (under the direction of the Commissioning Team). Care of the Facility will remain the responsibility of the Contractor until the Substantial Performance Certificate award.

.8 **Critical Failure:** A critical failure shall be deemed as one that prohibits the process from functioning successfully, or one that requires the use of available standby equipment, or one that creates a safety hazard.

1.3 COORDINATION AMONGST THE SUPPLIER, CONTRACTOR, SUBCONTRACTORS, ENGINEER AND THE DISTRICT

.1 The Commissioning period will not start until a copy of **Form 103** has been signed for each related System of Work, and Hand Over of operation of the Facility to The District has been completed. Refer to Section 01 65 00 for details.

1.4 PERSONNEL

.1 Suppliers must provide knowledgeable technical representatives during Commissioning, PT and/or GPT. The Engineer has the final say in determining if the Supplier's Representative is knowledgeable for Commissioning, PT and/or GPT activities. If in the opinion of the Engineer the Supplier's Representative is not knowledgeable, the Supplier must provide an alternate candidate.

1.5 COMMISSIONING TEAM

.1 For Commissioning Team definition refer to clause 1.2.

.2 The District will have ultimate authority for directing the operational aspects of Phase 1 and Phase 2 Commissioning effort. The Contractor will coordinate Commissioning, with assistance from the Engineer and The District.

.3 Responsibility for performance of the equipment and maintenance lies with the Contractor through Commissioning.

.4 Provide personnel representing the appropriate trades, including mechanical, electrical, control and instrumentation personnel during Commissioning. These personnel shall be skilled workers, able to expedite any minor repairs, adjustments, etc. as are required to complete Commissioning with as few delays as possible.

.5 The Supplier must make available as required, representatives who are experienced in on-site start-up and Commissioning (Phase 1 and Phase 2) of similar equipment.

1.6 COMMISSIONING PLAN

.1 Through a series of meetings, the Commissioning Team will develop a finalized detailed methodology for the Commissioning of each System at least sixty (60) days prior to the planned start of System Operational Testing. The plan will be prepared by the Contractor with full participation from The District, Engineer, Subcontractors (if required), and the Suppliers. The Contractor shall lead the development of the Commissioning plan, including scheduling meetings.

.1 All members of the Commissioning Team will attend Commissioning meetings held at the Engineer's Site office to develop the Commissioning plan.

.2 Include the following in the Commissioning plan:

.1 Detailed schedule of events, including but not limited to the schedule for completion of testing of all component parts of each System in accordance with Section 01650 prior to Commissioning.

.2 Methods for introducing flow required at the beginning of Commissioning process, and subsequently thereafter as required to restart equipment. District staff shall be responsible for implementation of these measures.

.3 Methods for disposing of flow treated through the portion of the plant that is being commissioned.

.4 Planned attendance schedule for the Subcontractors and Suppliers' Representatives.

.5 Contingency plans in the event of a process, electrical, or Instrumentation and Control (I&C) malfunction.

.6 Drawings and sketches as required illustrating the planned sequence of events.

.7 List and details for any temporary equipment (pumps, etc.) required to facilitate Commissioning. Supply all temporary equipment.

.8 The Commissioning plan must be reviewed and agreed by the Commissioning Team prior to implementation. The District will be the final arbiter of the plan's suitability.

1.7 TIMING

.1 Steps leading up to, and including, Commissioning may or may not occur consecutively.

.2 It may be necessary for the Contractor/Subcontractors to return to the Site, if installation has been completed earlier to the stage of testing, to carry out and complete testing of the Systems.

.3 Additional compensation will not be considered for delays and/or the need to return to Site for steps leading up to, and including, Commissioning.

Part 2 Products – Not Used

Part 3 Execution

3.1 PREPARATION

.1 All process, mechanical, electrical, control and miscellaneous equipment related to a System must be successfully installed and tested in accordance with Section 01 65 00 – Equipment Installation and Operational Testing and any specific requirements noted in other Sections. **Form 103** must be completed and signed for each System.

.2 The Control System governing the portion of Work to be commissioned must be functionally complete prior to introduction of Plant's secondary effluent, wastewater, or sludge, depending on the System, to the System. All alarms, safety interlocks and shutdown functions must be operational. All automated, programmed functions will be operational, so that no damage could result to the equipment or Plant when operated in automatic mode. Control and monitoring of the functions of the equipment will be fully achievable through the SCADA system.

3.2 SEQUENCE

.1 Systems will be commissioned in a logical manner. Test upstream components first to the degree possible.

.2 The following sequence of events must be followed:

.1 All Equipment components to be tested in accordance with Section 01 65 00 - Equipment Installation and Operational Testing.

.2 Control System tested and fully operational to operate the System through the Plant SCADA system in accordance with Section 01 65 00 – Equipment Installation and Operational Testing.

.3 Hand Over of operation of the Facility when the flow stream is introduced to the System.

.4 The District to start and run System in manual mode.

.5 The District to turn separate items of equipment to automatic in a planned and logical manner. Ensure that the control System is operating the equipment in a manner which precludes damage of the equipment and which is consistent with the process operating requirements.

.6 Seven (7) successful days of operation (with the last three (3) days to be consecutive) to satisfy the requirements of the Commissioning period in accordance with this Section.

.7 Substantial Performance Certificate will be granted upon successful completion of **"Certificate of Satisfactory Commissioning – Phase 1" (Form 104)** documentation.

3.3 COMMISSIONING

.1 During Commissioning on wastewater, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by The District and Engineer as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

.2 Process streams will be introduced to the System by the Commissioning Team in a manner which precludes the damage of any equipment or structures.

.3 During Commissioning, The District (under the supervision of the Commissioning Team) will be responsible for starting, stopping, modulating, varying the speed of, and otherwise controlling the equipment in the Systems located within the Work Package limits. The Contractor, Subcontractor(s), Supplier(s), and Engineer will provide support to The District.

.4 The Contractor will co-ordinate the efforts of all parties involved (the Supplier(s), Subcontractor(s), the Engineer, and The District) in planning and initiating the Commissioning.

.5 The Contractor, Subcontractor(s) and Supplier(s) must immediately undertake any remedial measures required to ensure operation satisfactory to the Engineer.

.6 Provide any temporary piping, valves, fittings, or related ancillary equipment necessary to conduct Commissioning, all at no additional cost to The District and take responsibility to ensure that temporary facilities employed are adequate to avoid failure.

.7 Should Commissioning reveal any defects under the scope of the Work, promptly remedy those defects and Commissioning is to continue to the satisfaction of the Commissioning Team. Take responsibility for additional costs incurred by the Engineer or The District, due to repeated days of failure of Commissioning caused by defects under the scope of the Work Package.

.8 The Facility shall operate continuously and successfully through the last three (3) days of Commissioning Phase 1. Minor failures shall not void the Commissioning period. A minor failure is defined as one which does not present a safety hazard, does not impact overall process functioning and can be temporarily overcome using available standby equipment.

.9 Every effort shall be made to ensure that the Commissioning period provides for the full and comprehensive operation of the supplied equipment under all anticipated normal and adverse operating conditions.

.10 Commissioning of the Work shall be considered complete when the process has operated successfully, in a stable manner, satisfying the design criteria for a period of three (3) consecutive days at the end of the Commissioning.

.11 The Commissioning Team shall prepare a report providing a summary of the Commissioning efforts and the results of the Commissioning sequence, documented, and summarized in a format acceptable to the Engineer and The District. The District and the Engineer reserve the right to request additional information.

.12 After Commissioning, remove any temporary facilities. Completion of this task will be required before signing of **Form 104**.

.13 On successful completion of Commissioning Phase 1, The District, Engineer and Contractor will sign the **"Certificate of Satisfactory Commissioning – Phase 1" (Form 104)** attached to this Specification.

3.4 COMMISSIONING ACCEPTANCE

.1 An acceptance meeting to be held at the end of Commissioning to confirm the status of the Facility. This meeting will be called by and coordinated by the Engineer and attended by The District, Engineer, Contractor, Subcontractor(s), and Supplier(s) (if required, depending on the System). The purpose of the meeting is to review the schedule of any remedial work necessary.

3.5 PERFORMANCE TESTING AND/OR GUARANTEED PERFORMANCE TESTING

.1 Subject equipment to Performance Tests and/or Guaranteed Performance Tests where specified in the Technical Specifications. These tests will be conducted either during or after the successful completion of System Operational Testing as defined by the signing of **Form 103**.

.2 Those Performance Tests and/or Guaranteed Performance Tests not completed during the System Operational Testing period will be conducted either concurrent with, or after, Commissioning, as practicable and agreed between the Engineer, Contractor and The District.

.3 Performance Tests and Guaranteed Performance Tests will be as dictated in the Technical Specifications.

.4 It is the responsibility of the Contractor, Subcontractor, and the Supplier to coordinate the preparation of the Performance Testing and/or Guaranteed Performance Testing, provide procedures consisting of detailed schedule of events, including but not limited to the schedule and method of demonstrating Performance and /or Guaranteed Performance and completion of testing of all component parts of the System being tested. The testing plan must also identify

the method that will be used to introduce materials, process the materials, and discharge the materials used through the Performance Tests.

.1 Supplier to lead preparation of the PT/GPT Plan with assistance from the Contractor and Subcontractor.

.2 Submit PT/GPT Plan to Engineer no later than sixty (60) days prior to start of PT/GPT.

.3 No testing work can commence until this plan has been reviewed by all parties involved and accepted by the Engineer and The District.

.5 Unless otherwise specified, the Supplier shall conduct PT/GPT (with operational control by The District and assistance from the Contractor and Subcontractors) to demonstrate critical performance requirements in accordance with the contract documents.

.6 The Supplier (with assistance from the Contractor and Subcontractors) will document the test procedures, sample data and analysis, calculations, test results, assumptions made, and other pertinent information in a Guaranteed Performance Test report and submit the report to the Contractor for review.

.7 Contractor to submit the results of the GPT to the Engineer, documented and summarized in a format acceptable to The District and the Engineer.

.8 The District and the Engineer reserve the right to request additional testing.

.9 Generally, equipment will not be classified as Accepted prior to the satisfactory completion of the equipment Performance Test(s) and acceptance of the test reports by The District and the Engineer.

.10 Should the PT and/or GPT reveals any defects, Supplier to promptly rectify those defects so that tests can be repeated until the equipment meets the PT and/or GPT criteria specified in the Work Package documents. Supplier to bear all additional costs incurred by the Contractor, The District or Engineer, due to repeat of PT and/or GPT.

.11 If, in the opinion of The District and the Engineer, the equipment does not meet one or more of the specified performance test acceptance criteria, the equipment will be rejected as not conforming to the performance guarantees. In this event:

.1 Supplier to modify the equipment or replace the equipment with new equipment and re-test such that the equipment will meet the specified PT and/or GPT requirements at no additional cost to The District. Supplier will bear all the associated cost related to the equipment modifications, replacement, or re-design.

.2 Re-testing of the modified or replacement equipment, in accordance with these Specifications, shall be completed by the Supplier as soon as the equipment is modified or replaced and within sixty (60) days of rejection of the initial Performance Tests. All tests and re-tests required to demonstrate conformance of the modified or replacement equipment with

the specified performance guarantees shall be at the expense of the Supplier.

.3 If, in the opinion of The District and the Engineer, the modified or replacement equipment meets all the specified Performance Test acceptance criteria, the equipment will be accepted as conforming to the performance guarantees.

.12 On successful completion of the Performance Test and/or Guaranteed Performance Test, the **"Certificate of Satisfactory Performance and/or Guaranteed Performance Testing" (Form 105)** attached to this Specification will be signed by the Manufacturer's or Supplier's Representative, the Contractor, The District and the Engineer.

CERTIFICATE OF SATISFACTORY COMMISSIONING
FORM 104

We certify that the District of Sooke Water Treatment Facility has been operated, tested and commissioned as per the Contract Documents for at least seven (7) successful days (with the last three (3) days to be consecutive) and that the equipment meets its operational and performance criteria, including fully automatic controls. The treatment equipment is therefore classed as "conforming".

PROJECT: _____

FACILITY: _____

_____

_____

_____

_____ _____

Print Name Signature Date

(Authorized Signing Representative of Contractor)

_____ _____

Print Name Signature Date

(Authorized Signing Representative of the Engineer)

_____ _____

Print Name Signature Date

(Authorized Signing Representative of The District)

CERTIFICATE OF SATISFACTORY PERFORMANCE AND/OR GUARANTEED PERFORMANCE TESTING
FORM 105

We certify that the equipment listed below has been tested and meets the Performance and/or Guaranteed Performance Testing requirements as set out in the Work.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name _____ Signature _____ Date _____
(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name _____ Signature _____ Date _____

(Authorized Signing Representative of the Contractor)

Print Name _____ Signature _____ Date _____

(Authorized Signing Representative of the Engineer)

Print Name _____ Signature _____ Date _____

(Authorized Signing Representative of The District)

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section contains requirements for training The District's operations and maintenance staff in the proper operations and maintenance of the equipment and systems installed under this Contract.

.2 Training sessions are required under this Contract prior to the System Operational Testing.

.3 Training is required for all equipment and components that comprise the Dewatering Equipment including polymer blending and feed equipment and sludge pumps.

.4 Allow at least one and a half (1.5) to seven (7) hours of training per operations and maintenance staff shift for each item of equipment for which training is required. Refer to the equipment specifications to indicate where training is required and for specific training time periods required for each equipment and system where training is required.

.5 Some training sessions are expected to have a longer duration, e.g. process system, control system, etc. The intent is that the operations and maintenance staff receive sufficient training on the equipment system that they are going to operate and maintain. The District will have the authority to determine the duration and content of each training session required.

1.2 QUALITY ASSURANCE

.1 Training includes instruction of The District staff in equipment operation and preventive maintenance.

.2 Where required by the equipment specifications, provide on-the-job training of the District staff. Training sessions will be conducted by qualified, experienced (2 years' experience minimum), factory-trained representatives of the various equipment Suppliers. The trainer(s) proposed by the Supplier will be conversant in all aspects of the equipment that is the focus of the training, an excellent communicator, and "trained in training" so that those he trains can in turn, train others.

1.3 SUBMITTALS

.1 Submit the information in accordance with Section 01 33 00 – Submittal Procedures. Template for required Training Materials is provided in Attachment A of this Section.

.2 Training submittals must be submitted in an electronic format at the same time as the initial Shop Drawing submission. Electronic format to follow the Specifications as defined in Section 01 33 00, clause 1.7.

.1 The **Commissioning Trainer Qualifications Forms** to verify the trainer's qualifications (refer to Attachment B of this Section)

.2 Training Plans and Training Materials, electronic copy of classroom presentation(s) with instructor's notes, handouts, visual aids, and other reference materials for each training session.

.3 Training schedule

.3 All Training Materials must be prepared using the templates and style guide attached to this Section (Attachment A) and include the original electronic files for any images, graphics etc. used in the materials.

.4 Subject to each training session, identity the qualifications of individuals to be conducting the training.

.5 Submit one (1) overall training schedule including the date, time, and duration for all training sessions. Coordinate training schedule with The District staff to accommodate the Plant's operations and maintenance schedule. Concurrent classes will not be allowed.

.6 The Engineer and The District will review the Training Plans and Training Materials within fifteen (15) Business Days of submittals.

Part 2 Products – Not Used

Part 3 Execution

3.1 LOCATION

.1 Where specified, conduct training sessions on the operation, care, and maintenance of the equipment and Systems installed in the Work. Training will take place at the work Site and under the conditions specified herein. Training Plans and Training Materials will be reviewed and accepted at least thirty (30) days prior to the date scheduled for the individual training session.

.2 The District or the Engineer may direct the classroom training to take place at another suitable location other than the WWTP.

3.2 TRAINING PLANS

.1 Contractor to administer the preparation of formal written Training Plans for each training session and coordinate with the Engineer and The District. Use the templates that are appended to, and form part of, this Section. Training Plans must contain a detailed outline of the material to be presented along with a

description of instructional strategies and visual aids to be utilized during the session. Each plan will contain a time allocation for each subject as well as detailing any related reference material such as Standard Operating Procedures (SOPs) or Operating Manuals. Provide finalized electronic copy of classroom presentation(s) with instructor's notes, handouts, visual aids, and reference materials.

.2 Provide one (1) copy of necessary training manuals, handouts, visual aids, and reference materials for each trainee at least three (3) weeks prior to each scheduled training session.

3.3 FORMAT AND CONTENT

.1 Include time in the classroom and at the location of the equipment or system for each training session. As a minimum, cover the following topics for each item of equipment or system:

- .1 Familiarization
- .2 Safety
- .3 Operation
- .4 Troubleshooting
- .5 Preventive maintenance
- .6 Corrective maintenance
- .7 Parts
- .8 Local representatives

.2 Modify all Training Materials to reflect the actual equipment supplied under this Work Package. Generic Supplier Training Material will not be accepted.

.3 The most recent versions of Training Materials, as submitted during the Shop Drawing Review Phase and updated to incorporate any changes/revisions to equipment or procedures mandated by The District and the Engineer's review, must also be modified to reflect changes introduced during installation and testing at the Site.

.4 If any Training Materials utilize U.S. or Imperial measurements, convert to Metric measurements.

.5 Provide separate files for all images (photos, diagrams, schematics) included in all Training Materials, either in high resolution .jpg or .png formats.

3.4 VIDEO RECORDING

.1 The District staff may video record any or all training sessions. After recording, the material may be edited and supplemented with professionally produced graphics to provide a permanent record for The District's use.

3.5 TRAINING SCHEDULE AND PRE-REQUISITES

.1 Conduct initial training in conjunction with the System Operational Testing period defined in Section 01 65 00 – Equipment Installation and Operational testing. Coordinate with The District and Engineer on class scheduling. Schedule classes such that classroom sessions are interspersed with field instruction in logical sequence, with no more than four (4) hours of classes scheduled for any one shift.

.2 Successful completion of initial training as defined by signing **Form T1** is a pre-requisite to System Operational Testing. Refer to Section 01 65 00 for more details.

3.6 EQUIPMENT AND SYSTEMS FOR TRAINING

.1 Provide initial training just prior to the System Operational Testing period for the following equipment and Systems:

.1 Pre-selected equipment.

.2 Process equipment as specified in Division 40

.3 Electrical equipment as specified in Division 25-26

.4 Instrumentation and control system as defined in Division 25-26

.2 Provide final training for the equipment mentioned in clause 3.6.1 during the warranty period (approximately six (6) months after the issue of Substantial Performance Certificate for the pre-selected equipment Supply Contracts and three (3) months after the issue of the Construction Completion Certificate for all the other equipment packages).

3.7 OPERATOR CLASSROOM TRAINING

.1 The Engineer will provide a brief introduction to training sessions (5 to 15 minutes) wherein he will identify the role of the process mechanical, electrical, I&C, or other equipment and system in the Project. This introduction will summarize the design intent and the basic sizing and operational criteria.

.2 As a minimum, the Supplier’s trainer will conduct classroom equipment training for operations personnel including:

.1 The equipment's specific location in the plant and an operational overview. Use slides and Drawings to aid discussion.

.2 Purpose and Plant function of the equipment.

.3 The operating theory of the equipment.

.4 The operating strategy of the equipment

.5 Design and operating parameters

.6 Equipment power requirements

.7 Start-up, shutdown, normal operation, and emergency operating procedures, including system integration and electrical interlocks, if any.

.8 Navigation tree chart applicable to the system control interface, if applicable

.9 Description of the control logic for Site specific programming, if applicable

.10 Screen shots with description of Site-specific operator interface screens, if applicable

.11 Description of operator interface screen icons, color schemes and functions, if applicable

.12 Operator adjustable control settings or parameters, if applicable

.13 Alarm set-points and shutdowns

.14 Operator response to alarms and shutdowns

.15 Safety items and procedures.

.16 Routine preventive maintenance, including specific details on lubrication and corrosion protection of the equipment and ancillary components.

.17 Operator detection, without test instruments, of specific equipment trouble symptoms.

.18 Adverse operating conditions

.19 Operator response to typical adverse operating conditions

.20 Required equipment exercise procedures and intervals.

.21 Routine disassembly and assembly of equipment if applicable for purposes such as operator inspection of equipment.

.22 Local representative(s) and company information

.23 Recommended spare parts

3.8 OPERATOR HANDS-ON TRAINING

.1 As a minimum, hands-on equipment training for operations personnel will include:

.1 Identifying instrumentation: Location of primary element; location of instrument readout; discuss purpose, basic operation, and information interpretation.

.2 Discuss and demonstrate operation of equipment in all modes of control (local-manual, remote-manual, and remote-automatic as appropriate).

.3 Demonstrate Human Machine Interface (HMI) through operator interfaced screens, if applicable

.4 Discuss and demonstrate all local panel operations and functions.

.5 Discuss and demonstrate operator adjustment of control settings and parameters.

.6 Discussing, demonstrating, and performing recommended operating methods and daily visual inspection of system operation.

.7 Discussing and performing the preventive maintenance activities.

.8 Discussing and performing start-up and shutdown procedures.

.9 Performing the required equipment exercise procedures.

.10 Performing routine disassembly and assembly of equipment if applicable.

.11 Identifying and reviewing safety items and performing safety procedures, if feasible.

3.9 MAINTENANCE CLASSROOM TRAINING

.1 Classroom equipment training for the maintenance and repair personnel will include:

.1 Basic theory of operation.

.2 Description and function of equipment.

.3 Routine start-up and shutdown procedures.

.4 Electrical power requirements

.5 Lockout procedures and the location of lockouts.

.6 Normal and major repair procedures.

.7 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.

.8 Routine and long-term calibration procedures.

.9 Safety procedures.

.10 Preventive maintenance such as lubrication; normal maintenance such as chain, belt, seal, and bearing replacement; and up to and including major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.

.11 Local representative(s) and company contact information

.12 Recommended spare parts

3.10 MAINTENANCE HANDS-ON TRAINING

.1 Hands-on equipment training for maintenance and repair personnel will include:

.1 Locating and identifying equipment components.

.2 Reviewing the equipment function and theory of operation.

.3 Reviewing normal repair procedures.

.4 Performing routine start-up and shutdown procedures.

.5 Reviewing and performing the safety procedures.

.6 Performing Owner-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

.7 Reviewing and using Supplier’s manuals in the hands-on training.

3.11 ELECTRICAL, INSTRUMENTATION AND CONTROLS TRAINING

.1 Electrical, instrumentation, and controls (EI&C) training shall be provided in the classroom and in the field, as required to convey required concepts to The District staff.

.2 Provide electrical, instrumentation and controls training for the following systems:

.1 Pre-selected equipment
.2 Process equipment as specified in Divisions 40
.3 Control systems
.4 Electrical equipment (refer to Division 25-26)
.5 Instrumentation (refer to Division 25-26)

.3 Training for E&IC shall include the following items in general.

.1 Overview of the electrical and instrumentation components included.
.2 Review of the equipment function and theory of operation.
.3 Overview of field instrumentation.
.4 Component by component review.
.5 Required maintenance activities.
.6 Troubleshooting.
.7 Configuration and calibration for each type of instrument and control device supplied.
.8 Control panel operation.
.9 Sequence of operation.

3.12 TRAINING COMPLETION FORMS AND PAYMENT

.1 **Form T1**: To be completed for initial training. One form is to be used for each System or piece of Major Equipment for which training has been provided.

.2 **Form T2**: To be completed for final training. One form is to be used for each System or piece of Major Equipment for which training has been provided.

.3 Samples of **Forms T1** and **T2** are attached to this Section.

.4 Payment for this Work will be released only when the training has been completed to The District's satisfaction and the respective forms are signed.

CERTIFICATE OF SATISFACTORY TRAINING
FORM T1

We certify that the initial training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name (Trainer)	Signature	Date

Print Name (Authorized Signing Representative of The District)	Signature	Date

Print Name (Authorized Signing Representative of the Contractor)	Signature	Date

CERTIFICATE OF SATISFACTORY TRAINING
FORM T2

We certify that the final training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name (Trainer)	Signature	Date

Print Name (Authorized Signing Representative of the Contractor)	Signature	Date

END OF SECTION

ATTACHMENT A PART 1

Template for Required Operator Training Materials

ATTACHMENT A PART2

Operator Training Plan Template

ATTACHMENT A PART 3

Operator Training Power Point Presentation Style Guide

[Your company logo here]

[Title of Training or Topic]

[Operator or Maintenance Training]

Trainer: [Name]

[Plant Title]

Table of Contents

FAMILIARIZATION

HEADING 2
Normal Text

SAFETY

OPERATION

TROUBLESHOOTING

PREVENTIVE MAINTENANCE

CORRECTIVE MAINTENANCE

PARTS

LOCAL REPRESENTATIVE

GLOSSARY

Include any abbreviations and acronyms

APPENDIX

[Insert your logo here]:

Training Session: **(insert title here)**

Instructors/Trainers: (insert names here)

Intended Audience: **(insert intended audience here – e.g. operators versus maintenance staff)**

Total Hours Training: (insert # hours here)

Topic	Key Point	Key Points Description/Details	Delivery Method	Time	Training Aids /Resources
Example: 1.0 Overview	General Systems Overview of Finning	Example: Scope of supply and how it relates to Treatment Facility (key points should address what, why, where, when and how the employee needs to know this information)	Examples: • Lecture • Demonstration • Hands on activity • Video	# minutes/hours of delivery for each topic. Specify all breaks. 10 minutes	• Examples: Handout (specify title) • PowerPoint (indicate corresponding slide numbers) • Operating or Maintenance Manuals (indicate relevant page numbers) • Diagrams • Video (specify title and/or web link) • Screen shot • Computer • Screen and LCD projector • Remote Connection
		Gensets		20 minutes	
		Switch gear		45 minutes	
		Fuel Blending			

[Insert your logo here]:

Topic	Key Point	Key Points Description/Details	Delivery Method	Time	Training Aids /Resources
		Controls			
	Health and Safety, Warning Signs				
	Functional Design Specification				
2.0 Control System	General System Information				
Total Time				## hours	

PowerPoint Presentation Style Guide

For District of Sooke WWTP Upgrade 2020

PowerPoint Slide

- Highlight key points or reinforce what the facilitator is saying
- Must be short and to the point, include only key words and phrases for visual, reinforcement

Logo

- Include your company logo on the title page only.

Fonts

- Font style must be readable. Select font style from the following options:
  - Arial, Tahoma, Veranda, Calibri
- Maximum of two font styles in any presentation
- Standardize the font throughout

Font Size

- The larger, the better. Slides must be readable, even at the back of the room.
- Titles must be 36 to 40 point and used consistently.
- Subtitle or bullet point size must be either 32, 28, 24 or 20 points
- Content text must be no smaller than 20 point

Caps and Italics

- **DO NOT USE ALL CAPITAL LETTERS**
  - City style is to avoid unnecessary capitalization. This helps create a more friendly and informal tone of communication.
  - In body copy, headlines, subheads, etc., the first letter of the initial word is capitalized (or upper case), followed by lower case.
  - Makes text hard to read
  - Conceals acronyms
  - Denies their use for EMPHASIS
- Italics
  - Used for “quotes”
  - Used to highlight thoughts or ideas
  - Used for book, journal, or magazine titles

Abbreviations and Acronyms

- Spell out acronyms and abbreviations in full the first time they appear, followed by the abbreviated version in parentheses.
- Include a glossary in the handout.

Use a Template

- Use a set font.
- Different styles are disconcerting to the audience.
- You want the audience to focus on what you present, not the way you present.
- Use the same background on each slide
- Don't use multiple backgrounds in your presentation

Graphs, Charts and Schematics

- Graphs, charts and schematics must be clearly legible when projected on screen and on computer monitor.
- If the image can't be easily read, provide a larger handout up to 11" X 17" that can be read.
- Original images of graphics, charts and schematics must be provided as separate files

Illustrations

- Use only when needed, otherwise they become distracters instead of communicators
- They must relate to the message and help make a point
- Ask yourself if it makes the message clearer
- Simple diagrams are great communicators
- Original images of graphics, charts and schematics must be provided as separate files
- Electronic files must be in format .jpeg or .png and high resolution.

Limit Each Slide to One Idea

- Use bullet points to cover components of each idea

Bullets

- Keep each bullet to 1 line, 2 at the most, maximum 8 lines of text per slide
- Limit the number of bullets in a screen to 6, 4 if there is a large title, logo, picture, etc.
    - This is known as "**cueing**"
    - You want to "**cue**" the audience on what you're going to say
        - Cues are a brief "preview"
        - Gives the audience a "framework" to build upon
- If you crowd too much text, the audience won't read it
    - Too much text looks busy and is hard to read
    - Why read it, when you're going to tell them what it says?
    - Our reading speed does not match our listening speed; hence, they confuse instead of reinforce

Limit Animation

- Use the same animation style and speed throughout the entire presentation
- No more than 1 style per presentation and must be consistent throughout
    - The audience will only see the animation and not the message you're trying to get across

Facilitator Notes

- Facilitator notes for each slide must be included using the Notes function in PowerPoint. If the notes are longer than what can be accommodated for each slide, please include a separate facilitator guide to accompany the PowerPoint presentation.
- PowerPoint presentations that are missing detailed facilitator instructions/notes are unacceptable and will be rejected.

Notes

- Any images, animations etc. used within the presentation must have their original electronic files included separately when submitting all training material to the Town of Lake Cowichan. They must be must be in format .jpeg or .png and high resolution.

Handouts

- Employees attending the training must receive a copy of the powerpoint presentation in handout format. A maximum of two slides per page can be printed on a page.
- Graphs, charts and schematics must be clearly legible when printed.
- If the image can't be easily read, provide a separate handout up to 11" X 17" as part of the handout package.

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Engineer or separate contractor.

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Engineer or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Remove samples of installed Work for testing.

.6 Provide openings in non-structural elements of Work for penetrations of electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill.

.10 Restore work with new products in accordance with requirements of Contract Documents.

.11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Engineer or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site.

.3 Clear snow and ice from access to site and buildings, remove from site.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use marked separate bins for recycling.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building and/or tunnel ventilation systems is not permitted for this purpose.

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

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris including that caused by Engineer or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched, or disfigured glass

.8 Remove stains, spots, marks and dirt from electrical and mechanical fixtures, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust tunnel interiors, behind grilles, louvres, and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps, and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with municipal and regional bylaws.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting four weeks prior to contract completion with Contract Administrator to:

.1 Verify Project requirements.

.2 Review manufacturer's installation instructions and warranty requirements.

.2 Contract Administrator to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 15 (fifteen) working days prior to the start of Commissioning activities, submit to the Contract Administrator, digital (PDF format) draft versions of the operating and maintenance manuals in English. Two weeks prior to Substantial Completion of the Work, submit to the Contract Administrator, four paper and one digital (PDF Format) copies of the final operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

.5 Pay costs of transportation.

1.3 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets. Digital copy in PDF format on DVDs.

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text, fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project.

.1 Date of submission; names.

.2 Addresses and telephone numbers of Contract Administrator and Contractor with name of responsible parties.

.3 Schedule of products and systems indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: refer to Section 01 66 40 - Training.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Contract Administrator one record copy of:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

- .1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

- .1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry, and legible condition.

- .1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Contract Administrator.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual and submit to Contract Administrator.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.

- .1 Do not conceal Work until required information is recorded. Meet with Contract Administrator on a weekly basis to review status of as-built drawings.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

1.7 FINAL SURVEY

.1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 66 20 – Commissioning and Performance Testing.

.15 Additional requirements: as specified in individual specification sections.

1.9 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.1 Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional requirements: as specified in individual specifications sections.

1.10 MAINTENANCE MATERIALS

.1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site, place, and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Contract Administrator.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock Materials:

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site, place, and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Contract Administrator.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.3 Special Tools:

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site, place, and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Contract Administrator.

.2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Contract Administrator.

1.12 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator's approval.

.3 Warranty management plan to include required actions and documents to assure that Contract Administrator receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Contract Administrator for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principals.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with Contract Administrator's permission, leave date of beginning of time of warranty until Date of Substantial Completion is determined.

.8 Include information contained in warranty management plan as follows:

- .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers, or suppliers involved.
- .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems.
- .3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names, and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.4 Contractor's plans for attendance at 4and 9-month post-construction warranty inspections.

.5 Procedure and status of tagging of equipment covered by extended warranties.

.6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.9 Respond in timely manner to oral or written notification of required construction warranty repair work.

.10 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

1.13 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Contract Administrator.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.
.3 Serial number.
.4 Contract number.
.5 Warranty period.
.6 Inspector's signature.
.7 Construction Contractor.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Include all concrete forms required for all concrete shown on contract documents including slabs, walls openings and similar.

1.2 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS

.1 Install materials specified to be supplied under other sections of these specifications. Materials include but are not limited to:

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

.2 Ensure installation is to the satisfaction of other sections and of the Owner's Representative prior to placing concrete.

1.3 REFERENCE STANDARDS

.1 Perform concrete forms work in accordance with the following standards, except where specified otherwise. Provide one copy on site of the first two standards listed below:

.1 BCBC 2012, British Columbia Building Code.
.2 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
.3 CSA-A23.3, Design of Concrete Structures.
.4 CSA-A23.4, Precast Concrete - Materials and Construction.
.5 ACI 350R, Environmental Engineering Concrete Structures.
.6 American Society for Testing and Materials (ASTM) where noted.
.7 Provincial safety standards where applicable.

1.4 REGULATIONS

.1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located and abide by the current laws and regulations regarding public safety.

.2 The codes and regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers' Compensation Board and other applicable acts administered by the authority having jurisdiction in the Province of British Columbia apply to the work of this section.

1.5 SAFETY

.1 Conform to good construction practice regarding safety.

.2 Carry out concrete forms work in accordance with the British Columbia Building Code.

1.6 QUALIFICATIONS

.1 Engage a professional Structural Engineer registered in the Province of British Columbia, fully qualified and experienced in the design of formwork and shoring, to be responsible for the design of formwork, scaffolding, shoring, re-shoring and all other components required for formwork erection.

1.7 SUBMITTALS

.1 Submittals shall be in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit all proposed joint details, locations, and construction procedures. Include waterstop, crack inducer, reglet, sealant and joint filler products as required.

.3 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or stating what action was taken.

1.8 SHOP DRAWINGS

.1 Submit shop drawings of formwork, shoring and re-shoring in accordance with Section 01 33 00 under the seal and signature of a professional Structural Engineer registered in the Province of British Columbia.

.2 Clearly indicate materials, sizes, grades, methods of construction, arrangement of joints, ties, shores, falsework, dimensions, spacings, schedule of erection, rate, and sequence of concrete placement, stripping requirements and design parameters.

.3 Clearly indicate all pertinent dimensioning, location of reglets and reveals and tie patterns.

.4 Where complicated forms are required, indicate construction methods and materials proposed to achieve clean, smooth, or straight concrete lines and smooth even surfaces free from bugholes, honeycombs and cold joints.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to the site in bundles easily identified and properly marked.

.2 Store and handle all form material on site in a manner to prevent damage and contamination.

1.10 QUALITY CONTROL

.1 The Contractor's professional Engineer responsible for the design of formwork is to inspect the fabrication and erection of formwork in accordance with the BCBC 2012 and Workers' Compensation Board.

.2 The Contractor is not to assign the responsibility of coordination of forming and placing other required material. Ensure a full-time qualified superintendent representing the Contractor is in attendance to inspect and check all phases of this work.

Part 2 Products

2.1 FORMWORK MATERIALS

.1 Plywood: Wood forms are not considered to be watertight and non-absorptive unless coated or scaled to prevent moisture absorption.

.1 Douglas fir conforming to CSA-O121 or softwood conforming to CSA-O151 as required to resist design loads imposed upon the forming system. Regular grade select tight face. Sound, undamaged sheets with clean, true finish.

.2 Exposed finished concrete (including painted or epoxy-coated concrete): Use medium density overlaid one side. Material to CSA-O121, smooth surface, undamaged sheets with clean, true edges. Re-use no more than five times. Allow Owner's Representative to inspect before each use.

.2 Lumber: Fir or spruce species, #2 Grade or better, conforming to CSA-O141 and to the design requirements of CSA-O86.1 to resist applied loads required of the forming system.

.3 Anchorage devices (including nails, bolts, spikes, and lag screws): Sized to ensure all formwork loadings are adequately resisted. Nails, spikes, and staples conforming to CSA-B111 galvanized or phosphatized.

.4 Steel forms: Minimum thickness 1.6 mm, well matched, tight fitting and adequately stiffened to support weight of concrete without deflection.

.5 Form ties for concrete below grade which is neither liquid retaining or dry areas below grade to be waterproofed.

.1 Snap off metal ties with metal form spacers, fixed or adjustable length to resist all forces that will break off 40 mm below the surface and permit a flush finish.

.6 Form ties for all interior concrete with unexposed finishes or concrete covered by an applied architectural finish:

.1 Snap off metal ties to resist all forces that will break off approximately 15 mm below the surface and permit a flush finish.

.7 Form ties for all exposed concrete including painted and/or epoxy-coated concrete as indicated in the room finish schedule:

.1 Snap off metal ties with 25 mm length cone to resist all forces to permit a recessed finish. Pattern to be symmetrical acceptable to the Owner's Representative.

.8 Form ties for all liquid retaining structures; tanks and channels, and for dry areas below grade where surfaces are to be waterproofed.

.1 Snap off metal ties with metal form spacers, fixed or adjustable length to resist all forces that will break off 40 mm below the surface and leave 25 mm cone.

.2 Removable form ties that leave through-holes in the water retaining structure are not permitted.

.9 Form Tie Hole Sealant: Non-shrink grout for interior exposed concrete or cementitious waterproofing for liquid retaining structures and dry areas below grade where surfaces are to be waterproofed.

.10 Form Release Agent: Colourless, non-staining, non-volatile type, NSF 61 approved. For exposed concrete finishes, use low viscosity agent to eliminate bugholes.

.11 Fillets for Chamfered Corners: Minimum 12 mm x 12 mm wood.

.12 Void Form: Closed celled expanded polystyrene complete with void spaces specifically designed to allow frost heave and swelling of soil under concrete without inducing uplift on the concrete. Structurally sufficient to support weight of wet concrete. Use 100 mm thick void form.

.13 Structural Slab on Grade Void Form Protection: Provide plywood or hard board as required over void form to protect the void form from crushing under construction activities and reinforcement chairing.

.14 Void Protection: Wood preserved pressure treated plywood; 12 mm thick by 250 mm high each side of void form to protect void space.

.15 Joint Details: Provide materials and sizes as shown on Contract Drawings.

Part 3 Execution

3.1 GENERAL

.1 Perform concrete formwork and falsework in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.

3.2 FORMWORK ERECTION

.1 Verify lines, levels, and centres before proceeding with formwork. Ensure that dimensions agree with drawings.

.2 Ensure that supplied equipment, hardware, and items to be cast-in will fit concrete dimensions.

.3 Construct formwork, shoring and bracing accurately to meet design and code requirements so that resultant finished concrete conforms to shapes, lines, levels, and dimensions indicated on drawings.

.4 Provide bracing to ensure stability of formwork. Prop or strengthen all previously constructed elements liable to be overstressed by construction loads.

.5 Arrange and assemble formwork to permit easy dismantling and stripping so that concrete is not damaged during its removal.

.6 Align joints and make watertight to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to a minimum. Obtain approval of Owner's Representative for location of form joints in exposed work.

.7 Chamfer external corners and edges of beams, columns and walls 20 mm when exposed or as noted.

.8 Construct formwork to maintain concrete tolerances in accordance with CSA-A23.1, Clause 10 unless closer tolerances are required for special conditions. Refer to drawings for special concrete tolerances.

.9 Camber beams: 0.2% of span unless otherwise noted.

.10 Camber slabs: 0.1% of span for all spans over 3 m.

.11 Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices, and embedded parts. 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 and keep moist prior to placing concrete.

.12 Do not re-use formwork with surface defects that will impair the appearance of finished concrete. Do not patch formwork. Meet the requirements of Part 2 of this section when re-using formwork.

.13 Obtain approval of Owner's Representative for use of earth forms when not shown on drawings. When using earth forms, hand-trim sides and bottoms and remove loose dirt prior to placing concrete. Increase concrete cover as required to 75 mm minimum.

.14 Provide sufficient space below grade beams and walls for void form and void protection. Place void form prior to reinforcement to ensure specified concrete cover.

.15 Separate slabs on grade from vertical surfaces with 6 mm or 12 mm thick joint filler where indicated on drawings. Extend joint filler from bottom of slab to within space required for joint sealant at finished slab surface.

.16 Form construction joints as indicated on the drawings.

.17 Form construction joints in accordance with CSA-A23.1 at locations indicated on the drawings or with the written approval of the Owner's Representative as follows:

.1 At centre of span of suspended slabs, beams, and joists.

.2 In walls directly over centroid of pile or pile cap if applicable.

.3 In grade beams at midspan.

.4 In walls and columns immediately above and below floor construction joints.

.18 Construction joints at centre of span of non-watertight suspended slabs, beams, and joists to be adequately doweled and keyed. Maximum concrete placement length for structural slabs to be 35 m unless otherwise indicated. Refer to drawings for construction joint locations and details.

.19 Construction joint spacing in non-watertight walls and grade beams maximum 12 m or as indicated on drawings.

.20 Construction joint spacing in slabs on grade maximum 24 m or as indicated on drawings.

.21 Construction joints spacing in all base slabs maximum 22.5m or as indicated on drawings.

.22 Construction joint spacing in walls of liquid retaining structures or dry areas below grade that are to be watertight are not to exceed 7.5 m and are to be approved prior to construction.

.23 Proposed construction joint locations and details to be approved by the Owner's Representative.

.24 Roughen surface of construction joints to sound concrete, dampen surface, apply cementitious waterproofing and bonding system prior to placing fresh concrete. Procedures specified in Section 03 30 00.

.25 Provide continuous waterstop at all construction joints in liquid retaining structures and dry area below grade structures with high ground water level to 600 mm above the water level and not less than the locations noted on the drawings.

3.3 FORMING OF EXPOSED CONCRETE

.1 The intent of this section is to ensure the formwork is of a high quality to result in exposed concrete surfaces free of unsightly cold joints, blemishes, bugholes, honeycombing and cracking. Acceptable symmetrical joint patterns are mandatory.

.2 Formwork to be in accordance with CSA-A23.1, Clause 27.

.3 Allow Owner's Representative to inspect and approve each section of formwork prior to placing reinforcement.

.4 Control joint and placement break spacings outlined on structural drawings are maximum allowable.

.5 All horizontal and vertical joints are to result in a satisfactory symmetrical pattern approved in advance of forming by the Owner's Representative.

.6 All reglets in walls and railings to also extend over top of the wall or railing.

.7 Caulk or otherwise seal all form joints including corners to prevent bleeding of fines.

.8 Provide reglets to forms at all vertical placement breaks and as indicated or detailed. Caulk reglet formwork to prevent bleeding of fines from concrete.

.9 Replace damaged forms and forms with poor surfaces with new material as directed by the Owner's Representative.

.10 Chamfer all exposed edges and corners.

3.4 VOID FORM

.1 Ensure void form is in place and not damaged prior to placing concrete (top void form protection is required to protect the void form from construction activities).

.2 Install top void form protection for structural slabs on grade.

3.5 INSERTS/EMBEDDED PARTS/OPENINGS

.1 Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded in and passing through concrete members.

.2 Refer to architectural, mechanical, electrical, instrumentation and process drawings for sleeves and openings required through structural components. These are not to reduce the structural capacity. Locations and sizes not shown on the structural drawings are to be approved in writing by the Owner's Representative.

.3 Maximum size of conduit in structural slabs is 1/5 of solid portion of the slab thickness, and where more than two are adjacent to each other, they are to be spaced 100 mm apart. Conduit is to be placed in the middle third of the slab unless otherwise specified or approved in writing by the Owner's Representative.

.4 Provide recesses in top of foundation walls at all doors and openings to allow slab to bear on walls.

.5 Accurately locate and set in place items that are to be cast directly in concrete.

.6 Coordinate work of other sections and cooperate with the trade involved in forming and/or setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform work unless specifically indicated on drawings or approved prior to installation.

.7 Do not place anchor bolts, sleeves, and inserts into freshly placed concrete. Tie firmly into place prior to placing concrete.

.8 Install all concrete accessories in accordance with drawings and manufacturer's recommendations, straight, level, and plumb. Ensure adequate support to prevent movement during concrete placement.

.9 Ensure all waterstop are continuous and properly installed and sealed watertight.

.10 Ensure all waterstop are securely fastened to prevent folding during concrete placement.

.11 Ensure all openings for pipes or sleeves through liquid retaining structures properly address watertight requirements.

3.6 CLEANING FORMS

.1 Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings, and debris from within forms. Flush completely with water or compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

.3 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight-fitting panels, flush with inside of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

3.7 FORM REMOVAL

.1 Comply with CSA-S269.1 for dismantling all falsework.

.2 Do not remove forms, shores and bracing until concrete has gained sufficient strength to carry its own weight, construction loads and the design loads that are liable to be imposed upon it.

.3 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete but not before a minimum of three days from final concrete placement to prevent rapid loss of moisture from concrete. Earlier removal may be allowed provided acceptable curing is maintained.

.4 Arrange forms to allow removal without removal of principal shores where these are required to remain in place.

.5 Retain shores and forms under structural members for a minimum of 14 days or until the concrete has attained 75% of the required 28 days strength, whichever occurs later.

.6 Verify strength by field cylinders or insert type tests in accordance with ASTM C900-T.

.7 Remove formwork progressively and in accordance with code requirements so that no shock loads or unbalanced loads are imposed on structure.

.8 Loosen forms carefully. Do not damage concrete by wedging pry bars, hammers, or tools against concrete surfaces.

.9 Re-shore structural members as required for design or construction conditions. Construction is to be re-shored to carry all future anticipated construction loading unless otherwise approved in writing by the Owner's Representative.

3.8 CERTIFICATION

.1 At the completion of formwork and shoring, certify all formwork components fabricated and erected by the Contractor under the seal and signature of the Contractor's professional Engineer responsible for this work.

.2 Certify that all formwork, shoring, and components can support all the construction loads and forces required to complete the cast-in-place concrete work.

.3 Certify that all formwork, shoring, and components are fabricated and erected in accordance with the reviewed shop drawings.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Include all concrete accessories required for construction of reinforced concrete elements including anchors, pins, plates, inserts, sleeves, etc as shown on Contract Drawings.

.2 Payment Fabrication, procurement installation, including all material and labour, shall be considered incidental to concrete placement.

1.2 REFERENCE STANDARDS

.1 Perform concrete accessories work in accordance with the following standards, except where specified otherwise. Provide one copy on site of the first two (2) standards listed below.

.1 BCBC 2012, “British Columbia Building Code”.
.2 CSA-A23.1, “Concrete Materials and Methods of Concrete Construction”.
.3 CSA-A23.3, “Design of Concrete Structures”.
.4 CSA-A23.4, “Precast Concrete - Materials and Construction”.
.5 ACI 350R, “Environmental Engineering Concrete Structures”.
.6 American Society for Testing and Materials (ASTM) where noted.
.7 American Concrete Institute Detailing Manual (ACI 315) where noted.
.8 Provincial safety standards where applicable.
.9 Conform to applicable safety regulations for erection, maintenance, and removal of formwork.

1.3 REGULATIONS

.1 Abide by the current bylaws and regulations of the province, District and/or Municipality in which the work is located and abide by the current laws and regulations regarding public safety.

.2 The codes and regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers’ Compensation Board and other applicable acts administered by the authority having jurisdiction in the Province of British Columbia apply to the work of this section.

1.4 SAFETY

.1 Conform to good construction practice regarding safety.

.2 Carry out concrete accessories work in accordance with the British Columbia Building Code.

1.5 SUBMITTALS

.1 Submit data on all concrete accessories specified or proposed.

.2 Submit all proposed joint details, locations, and construction procedures. Include waterstop, crack inducer, reglet, sealant and joint filler products as required.

.3 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or stating what action was taken.

1.6 SHOP DRAWINGS

.1 Submit shop drawings of all accessories where required in accordance with Section 01 33 00 indicating where used and how accessories are to be placed.

.2 Clearly indicate all pertinent dimensioning, arrangements, and locations of concrete accessories.

1.7 SAMPLE PANELS

.1 Provide concrete accessories for placement in a sample formwork panel for each architectural concrete surface receiving special treatment, painted finish, or exposed finish because of formwork. Construct 2400 x 2400 in size to fully indicate special treatment or finish required, and include reglets, cone ties and tie pattern and other patterns detailed.

.2 The approved sample concrete panels are to be considered a basis of quality for the accessory work. Locate where directed.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to the site in bundles easily identified and properly marked.

.2 Store and handle all material on site in a manner to prevent damage and contamination.

1.9 QUALITY CONTROL

.1 The Contractor is not to assign the responsibility of coordination of concrete accessories and placing required material. Ensure a full-time qualified superintendent representing the Contractor is in attendance to inspect and check all phases of this work.

1.10 INSPECTION AND TESTING OF DRILLED ANCHORS

.1 The Contractor is to ensure drilled anchors are tested by a testing firm certified in accordance with CSA-A283.

.2 An independent testing firm may be retained and paid for by The Owner and approved by the Owner's Representative in accordance with Section 01 40 00 of this specification.

.3 The independent testing firm will only provide the minimum testing as required by The Owner and does not relieve the Contractor of his responsibilities to test all drilled anchors to ensure anchors conform to the requirements of the Contract Documents.

.4 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials. Provide free access to all portions of the work and cooperate with the testing firm.

.5 Test anchors to 150% of the greater tension working load indicated on the drawings or as specified by the manufacturer.

.6 The Contractor is to perform the following minimum testing:

.1 For 500 anchors or more, test 5% of anchors.
.2 For 100 to 499 anchors, test 7% of anchors.
.3 For 50 to 99 anchors, test 10% of anchors.
.4 For 20 to 49 anchors, test 14% of anchors.
.5 For 10 to 19 anchors, test 20% of anchors.
.6 For 1 to 9 anchors, test 33% of anchors.

.7 Repair or replace anchors not meeting the specified requirements and re-test. Test up to ten additional anchors where a failure occurs. Re-testing and additional testing paid for by the Contractor.

.8 The Contractor's testing firm is to submit to the Owner's Representative certified test results within two (2) days.

Part 2 Products

2.1 CONCRETE ACCESSORIES

.1 Expansion Joints: Eva-Cap.

.2 Expansion Joint Compression Seals: Hydrozo Jeena Seal.

2.2 WATERSTOP

.1 Waterstops: To CGSB 41-GP-35M. Purpose made polyvinyl chloride, minimum 14 MPa tensile strength, -50°C to 80°C working temperature range, 150 mm wide, center bulb, maximum possible lengths, profiled as indicated on the drawings. Use Durajoint Type 5, 5A, or Greenstreak No. 705 and 732.

2.3 BONDING AGENTS

.1 Bonding agent:

.1 Two or three-component modified epoxy resin. Use for construction joints in non-watertight structures and rock anchor recesses only.

.2 Use cementitious waterproofing for construction joints in liquid retaining structures such as tanks and channels and for dry areas below grade which are to be watertight.

2.4 SEALANTS

.1 Joint Sealant: Provide materials and sizes as shown on the Contract Drawings.

2.5 DRILLED ANCHORS

.1 Drilled Anchors:

.1 Use type 316 grade B8M stainless steel Hilti HVA adhesive anchor as indicated on drawings.

.2 Use type 316 grade B8M stainless steel anchor bolts or threaded rods, reinforcement dowels with Hilti HY200 grout or ITW Ceramic 6 grout as indicated on drawings. Use standard embedment depths per Hilti HY200 grouting system.

Part 3 Execution

3.1 GENERAL

.1 Perform concrete accessories work in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.

3.2 FORMWORK ERECTION

.1 Ensure that supplied accessories, hardware, and items to be cast-in will fit concrete dimensions.

.2 Ensure concrete surfaces of construction joints are properly prepared for application of epoxy bonding agent or cementitious waterproofing immediately prior to placing fresh concrete. Use cementitious waterproofing in liquid retaining structures and dry areas below grade.

.3 Provide continuous waterstop at all construction joints in liquid retaining structures and dry areas below grade structures with high ground water level to 600 mm above the liquid or ground water level and not less than the locations indicated on the drawings.

3.3 FORMING OF EXPOSED CONCRETE

.1 The intent of this section is to ensure the accessories for formwork are of a high quality to result in concrete surfaces free of unsightly cold joints, blemishes, bugholes, honeycombing and cracking.

.2 Allow Owner's Representative to inspect and approve accessories placed in formwork prior to placing concrete.

.3 Ensure that reglets to be placed in formwork are acceptable for joint sealants.

.4 Fill all exterior reglets in walls below grade and in liquid-retaining structures as indicated on the drawings with an approved cementitious waterproofing.

3.4 CONCRETE ACCESSORIES

.1 Install all concrete accessories in accordance with drawings and manufacturer's recommendations, straight, level, and plumb. Ensure adequate support to prevent movement during concrete placement.

.2 Install stair nosing centered on all concrete stairs in accordance with the manufacturer's written recommendations.

.3 Install waterstops continuous without displacing reinforcement. Do not nail through waterstops. Heat seal all joints watertight.

.4 All joints except straight butt joints to be fabricated by the manufacturer in the manufacturer's shop.

.5 Wire all waterstop to reinforcing to prevent folding during concrete placement.

3.5 PLACING CONCRETE

.1 Ensure all accessories and hardware and all other items to be cast into concrete are placed securely and will not cause undue hardship in placing concrete.

.2 Ensure all accessories and hardware, inserts, embedded parts, formed expansion and contraction joints and other critical items are not disturbed during concrete placement.

.3 Ensure all waterstop is securely wired to reinforcing to prevent folding or movement during concrete placement. Maintaining the integrity and correct position of waterstop is critical to the performance of the structure.

3.6 CLEANING

.1 Repair, remove and clean all drips and smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Supply and place steel reinforcement shown or otherwise indicated on Contract Drawings.

.2 Payment Fabrication, procurement installation, including all material and labour, shall be considered incidental to concrete placement.

1.2 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS

.1 Install materials specified to be supplied under other sections of these specifications.

.2 Ensure installation is to the satisfaction of sections concerned and of the Owner's Representative prior to placing concrete.

1.3 REFERENCE STANDARDS

.1 Perform concrete reinforcement work in accordance with the following standards, except where specified otherwise. Provide one copy on site of the first two standards listed below.

.1 BCBC 2012, "British Columbia Building Code".

.2 CSA A23.1, "Concrete Materials and Methods of Concrete Construction".

.3 CSA A23.3, "Design of Concrete Structures".

.4 CSA A23.4, "Precast Concrete - Materials and Construction".

.5 ACI 350R "Environmental Engineering Concrete Structures".

.6 American Society for Testing and Materials (ASTM) where noted.

.7 American Concrete Institute Detailing Manual (ACI 315) where noted.

.8 Concrete Reinforcing Steel Institute (CRSI) where noted.

.9 Reinforcing Steel Institute of Canada (RISC), "Manual of Standard Practice, Metric Supplement" where noted.

.10 Provincial safety standards where applicable.

1.4 REGULATIONS

.1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located and abide by the current laws and regulations regarding public safety.

.2 The codes and regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers' Compensation Board and other applicable acts administered by the authority having jurisdiction in the Province of British Columbia apply to the work of this section.

1.5 SAFETY

.1 Conform to good construction practice regarding safety.

.2 Carry out concrete reinforcement work in accordance with the British Columbia Building Code.

1.6 SUBMITTALS

.1 Submit results of ladle analysis of all reinforcement to be spliced by welding and submit Manufacturer's information and test reports for mechanical splices of all reinforcement to be mechanically spliced.

.2 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or stating what action was taken.

1.7 SHOP DRAWINGS

.1 Submit shop drawings of reinforcing steel in accordance with Section 01 33 00.

.2 Clearly indicate bar sizes, bending and cut lengths, spacings, locations and quantities of reinforcing steel and wire fabric. Submit bending and cutting schedules and supporting and spacing devices.

.3 Use large scale details for areas of congested reinforcement.

.4 Support and placing details of reinforcing to ACI 315 and RISC.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to the site in bundles easily identified and properly marked.

.2 Store and handle all material on site in a manner to prevent damage and contamination.

.3 Do not straighten or re bend any reinforcement.

.4 Do not use any reinforcement that has been kinked or bent on site.

1.9 QUALITY CONTROL

.1 The Contractor is not to assign the responsibility or coordination of placing reinforcing steel and placing other required material. Ensure a full-time qualified superintendent representing the Contractor is in attendance to inspect and check all phases of this work.

1.10 INSPECTION AND TESTING OF REINFORCEMENT

.1 The Contractor is to ensure concrete reinforcement is tested by a qualified testing firm.

.2 The independent testing firm will only provide the minimum testing as required by The Owner and does not relieve the Contractor of his responsibility to test all reinforcements to ensure concrete reinforcement work conforms to the requirements of the Contract Documents.

.3 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials. Provide free access to all portions of the work and cooperate with the testing firm.

.4 Provide samples of reinforcement as delivered to the site for testing if requested.

.5 The Contractor is to inspect and test all concrete reinforcement work to ensure compliance with the Contract Documents.

.6 The Contractor's testing firm is to submit to the Owner's Representative certified test results within two days.

Part 2 Products

2.1 REINFORCING MATERIALS

.1 Reinforcing steel: To CAN/CSA G30.18, 400 MPa yield grade deformed billet steel bars.

.2 Reinforcing steel: To CAN/CSA G30.18, 400W MPa yield grade special low alloy deformed billet steel for welding. The equivalent carbon content is not to exceed 0.5.

.3 Welded steel wire fabric: To CSA G30.5, flat sheets.

.4 Chairs, bolsters, bar supports, spacers: Adequate strength for support of reinforcing. Metal pipe, stone or wood are not acceptable.

.1 Where concrete is exposed to view, exposed to elements or where rust is possible use plastic or non-corrosive material, or precast concrete made from concrete of equal strength and durability to concrete being placed. Chairs used are not to result in voids or unacceptable appearance in exposed concrete surfaces.

.2 For liquid-retaining structures and dry areas below grade use precast concrete made from concrete of equal strength and durability to concrete being placed. Chairs used are not to result in voids or unacceptable appearance.

.5 Slab on grade chairs and bar supports: Precast concrete of correct height. Metal pipe, stone or wood are not acceptable.

.6 Tie wire: Minimum 1.6 mm annealed type or patented system approved by the Owner's Representative.

.7 Mechanical splices at locations where reinforcing cannot be lap spliced for compression as for full tension.

2.2 FABRICATION OF CONCRETE REINFORCEMENT

.1 Fabricate reinforcement hooks, bends, laps, and similar details to CSA A23.1, ACI Detailing Manual 315 and Metric Supplement of the Reinforcing Steel Institute of Canada (RISC) Manual of Standard Practice and in accordance with the drawings and specifications and the reviewed shop drawings.

.2 Verify dimensions of existing work prior to commencing fabrication.

.3 Verify all drawing dimensions and conditions prior to commencing fabrication.

.4 Bend all reinforcement cold unless otherwise approved by the Owner's Representative.

.5 Provide column and wall dowels from foundations and base slabs using same reinforcing as in columns and walls unless noted otherwise on the drawings.

.6 Provide all additional support bars as required to support all main reinforcement indicated.

.7 Provide stirrup support bars sized to match stirrup size in hooks or corners of beam stirrups unless noted otherwise on drawings.

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

.9 Provide mesh over electrical conduit, ductwork or piping buried in slabs with strips of 102 x 102 x MW13.3 x MW13.3 welded wire fabric 300 mm each side. If principal slab reinforcement is placed above conduit, then place strips under conduit. Position of reinforcing steel takes precedence over conduit, ductwork, or piping.

.10 Locate reinforcing splices not indicated on drawings at points of minimum stress. Location of splices is to be approved by the Owner's Representative.

.11 Refer to structural drawings for minimum splices. Splice lengths as indicated on the drawings.

.12 Weld reinforcement where indicated and only by an organization certified under the requirements of CSA W186. Do not weld reinforcing at any location without written approval of the Owner's Representative.

.13 Test all welded reinforcement splices unless noted.

.14 Provide minimum reinforcing to slabs on grade unless otherwise noted: 100 mm slabs: 305 x 305 x MW66.7 x MW66.7 "step through" mesh. 125 mm and 150 mm thick slabs: 305 x 305 x MW100 x MW100 "step through" mesh. An alternative using tied reinforcing steel providing the equivalent reinforcing value will be considered if approved in writing by the Owner's Representative.

.15 Lap adjacent sheets of welded steel wire fabric to provide an overlap of at least one cross wire spacing plus 50 mm.

Part 3 Execution

3.1 GENERAL

.1 Perform concrete reinforcement work in accordance with requirements of CSA A23.1 unless indicated otherwise on the drawings.

3.2 PLACING REINFORCING STEEL

.1 Place reinforcing steel in accordance with CSA A23.1, Clause 12.

.2 Place reinforcement within a tolerance of ±6 mm for slab steel and ±12 mm for other steel. Bends and end of bars to be within 50 mm of specified location. Adequately support and secure reinforcement to prevent movement within the allowable tolerances before and during placing of concrete.

.3 Place and secure all reinforcement in its correct position prior to placing any concrete. Do not adjust or place reinforcement in freshly placed concrete.

.4 Reinforce around openings as noted on structural drawings.

.5 Supply and place all necessary support accessories, whether specifically detailed or not, to ensure proper placement of reinforcing steel.

.6 Use non-corrosive or non-stain supports for reinforcing when concrete is exposed.

.7 Support slab on grade, structural slab, foundation, and base slab reinforcement at 900 mm maximum on centre.

.8 Supply bar support chairs for top reinforcing bars in sufficient quantity to not exceed 900 mm average spacing in each direction.

.9 Supply chairs to support temperature reinforcing or mesh to maintain minimum covers specified.

.10 Ensure supports are such that they are not forced into the supporting formwork or soil and do not break or collapse from the weight of reinforcement and other construction loads.

.11 Supply horizontal reinforcing spacers in walls to ensure reinforcing does not move during placement.

.12 Support reinforcement laterally in pairs on opposite faces of walls, columns, and beams.

.13 Provide minimum concrete cover to reinforcing steel as indicated on the drawings.

.14 Do not re bend or straighten reinforcing steel after initial fabrication unless so indicated on the drawings.

.15 Ensure reinforcing is clean, free of loose scale, dirt, oil, rust, and other foreign coatings.

.16 Place reinforcement for interior and exterior slabs on grade as indicated on drawings. Place and support uniformly above centre line of the slab, and have a minimum concrete cover of 50 mm.

.17 Place reinforcing for slab on grade on precast concrete chairs or other approved supports at correct height.

.18 Obtain written approval from the Owner’s Representative prior to cutting of reinforcing to accommodate openings, or embedded items or to accommodate

precast concrete, structural steel, or timber connections. Allow for additional splice material which may be required to reinforce these cut bars as directed by the Owner's Representative.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Supply and place concrete shown or otherwise indicated on Contract Drawings.

1.2 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS

.1 Install materials specified to be supplied under other sections of these specifications. Materials include but are not limited to:

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

.2 Ensure installation is to the satisfaction of sections concerned and to the Owner's Representative prior to placing concrete.

1.3 REFERENCE STANDARDS

.1 Perform cast-in-place concrete work in accordance with the following standards, except where specified otherwise. Provide one copy on site of the first two standards listed below.

.1 BCBC 2012, "British Columbia Building Code".
.2 CSA-A23.1, "Concrete Materials and Methods of Concrete Construction".
.3 CSA-A23.2, "Methods of Test for Concrete".
.4 CSA-A23.3, "Design of Concrete Structures".
.5 CSA-A23.4, "Precast Concrete - Materials and Construction".
.6 CAN/CSA-A3000, "Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004, and A3005)."
.7 ACI 350R, "Environmental Engineering Concrete Structures".
.8 American Society for Testing and Materials (ASTM) where noted.
.9 Provincial safety standards where applicable.

1.4 REGULATIONS

.1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located and abide by the current laws and regulations regarding public safety.

.2 The codes and regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers' Compensation Board and other applicable acts administered by the authority having jurisdiction in the Province of British Columbia apply to the work of this section.

1.5 SAFETY

.1 Conform to good construction practice regarding safety.

.2 Carry out cast-in-place concrete work in accordance with the British Columbia Building Code.

1.6 SUBMITTALS

.1 Submit information on the quality of all proposed concrete making materials and the proposed mix designs for all concrete and grout mix types to the Owner's Representative for approval two weeks prior to their initial use.

.2 Submit data to confirm compatibility of all proposed admixtures with the proposed Portland Cements and supplementary cementing materials.

.3 Submit data sheets for all proposed pre-mixed grouts to the Owner's Representative for review.

.4 Submit samples of fine and coarse aggregate and all admixtures proposed for concrete mixes to the testing firm's laboratory if requested by the Owner's Representative.

.5 Submit all proposed saw cut and joint details, locations, and construction procedures. Include waterstop, crack inducer, reglet, sealant and joint filler products as required.

.6 Submit all proposed curing procedures and product data sheets.

.7 Submit proposed methods of protection of concrete when air temperatures are expected to be above 25°C or below 5°C.

.8 Submit proposed procedures for applying separate bonded topping.

.9 Submit details of the proposed bonding system for bonded topping and construction joints.

.10 Changes in concrete mix proportions or source of materials are subject to submission of information on new proposed materials and approval of the Owner's Representative.

.11 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or stating what action was taken.

1.7 QUALITY CONTROL

.1 The Contractor is not to assign the responsibility of coordination of placing required material and placing concrete. Ensure a full-time qualified

superintendent representing the Contractor is in attendance to inspect and check all phases of this work.

1.8 INSPECTION AND TESTING OF CONCRETE

.1 The Contractor is to ensure all concrete is tested by a testing firm certified in accordance with CSA-A283.

.2 An independent testing firm will be retained and paid for by the Contractor in accordance with Section 01 40 00 of these specifications.

.3 The Contractor is responsible to test all concrete to ensure concrete work conforms to the requirements of the Contract Documents.

.4 The Contractor is to provide properly designed temperature-controlled storage boxes for test cylinders, as specified in CSA-A23.2-3C, for a period of at least 24 hours and further protection from adverse weather and mishandling until removed from the site. The Contractor is to provide a max-min thermometer for each storage box. Storage of test cylinders in a portable building that will be used by the Contractor's personnel or the Owner's Representative during the first 24-hour storage period will not be permitted. Storage facilities are to be provided, installed, checked, and approved by the Owner's Representative before any concrete may be placed.

.5 The Contractor is to secure sufficient 3- and 7-day field cured/laboratory cured test cylinders for testing of concrete to ensure quality control and sufficient strength for application of construction loads and stripping. Cost for these additional tests to be borne by the Contractor.

.6 The Contractor is to inspect and test all cast-in-place concrete work to ensure compliance with the Contract Documents.

.7 The testing firm will review information on all concrete making materials and all mix designs submitted and confirm in writing that all mix designs are consistent with the specified concrete strength and durability requirements.

.8 Testing firms are to conduct all tests in accordance with CSA-A23.2.

.9 Samples of concrete to be taken as close to the point of final deposit in the form as possible, at end of pipe when pumping is used.

.10 Sampling of concrete for acceptability tests will be done at the discharge pipe of the concrete pump. The Contractor is to provide a suitable testing station in a location suitable to the Owner's Representative and convenient to the point of sampling. The testing station will be required to be moved from time to time during placement.

.11 Testing firms are to take a minimum of three (3) test cylinders for a strength test.

.12 The testing firm will take at least one (1) strength test for each 50 m^3 of concrete, or portion thereof, for each type of concrete placed and not less than one (1) test for each type of concrete placed in any one day.

.13 Testing firms are to moist cure and test one (1) cylinder in 7 days and to moist cure and test the remaining two (2) cylinders in 28 days.

.14 Contractor is to take at least one additional test cylinder during cold weather concreting and cure on job site under same conditions as the concrete it represents.

.15 Testing firms are to take at least one slump test and one air content test for each set of test cylinders taken.

.16 The testing firm is to take one slump test and one air test for every third load of concrete placed for liquid retaining structures.

.17 Testing firms are to report results of tests immediately to the Contractor and the Owner's Representative. The Contractor is responsible for ensuring that the concrete meets the requirements of the specifications. Report adverse test results to the Owner's Representative immediately.

.18 The testing firm is not authorized to revoke, relax, enlarge, or release any requirements of the specification, nor to approve or disapprove any portion of the work.

.19 Testing firms are to advise placing crew superintendent to halt placing of non-compliant concrete immediately, and thereafter request Contractor to reject the non-compliant concrete. The execution, or lack of execution, of this request is to be recorded.

.20 Testing firms are to submit to the Owner's Representative and Contractor certified copies of test results. Include the following information with the results within two days:

.1 Name of the project.
.2 Date of sampling.
.3 Mix design, specified strength, slump, and air content.
.4 Name of supplier, truck, and ticket number.
.5 Time batched and time placed.
.6 Identification of sampling and testing technician.
.7 Cement type and admixtures used.
.8 Exact location in the structure of the concrete sampled.
.9 Ambient air and concrete temperatures.
.10 Nominal aggregate size.
.11 Water added and personnel authorizing additional water.

.21 The Contractor's testing firm is to submit to the Owner's Representative final reports stating whether all concrete and grout is in accordance with the contract documents. Submit these reports under the seal and signature of a professional Engineer registered in the Province of British Columbia.

.22 Reject and do not place concrete with slumps greater than maximum specified, air content lower than minimum specified and concrete over 2 hours from batch time.

1.9 AGGREGATE TESTS

.1 The Contractor is to conduct tests on and submit the results of each source of proposed aggregates to confirm that the aggregates satisfies all the requirements of CSA-A23.1.

.1 Alkali Aggregate Resistivity (AAR).

.2 British Columbia aggregates are known to be at least moderately reactive with respect to AAR.

.3 All concrete mix designs are to be prepared to consider AAR durability as per guidelines in CSA-A23.2 method 27A.

.2 If the fine aggregate consists of a blend from more than one source, the fine aggregate sieve analysis is to show the gradation of the blended fine aggregates. Similarly, in the case of blended coarse aggregates, the coarse aggregate sieve analysis is to indicate the gradation of the blended coarse aggregates.

.3 All aggregate tests are to be conducted by an approved independent third-party laboratory certified in accordance with CSA-A283 to Category II. Following completion of all tests, the laboratory is to declare that the aggregate is fully acceptable for the intended use and that it will provide good long-term performance. All test results and evaluations are to bear the seal of a professional Engineer registered in the Province of British Columbia.

.4 Aside from the potential expansivity test, the analyses of the aggregates are to be current. Sampling and testing are to be done not more than 90 days prior to concrete production unless otherwise approved by the Owner's Representative. Additional analyses of more recent sampling are to be provided periodically if so directed.

.5 All costs associated with these specified aggregate tests are to be borne by the Contractor.

1.10 INSPECTION AND TESTING OF UNIT MASONRY CONCRETE CORE FILL

.1 All clauses pertaining to inspection and testing of concrete contained in this specification are to apply to unit masonry concrete unless noted otherwise.

.2 The independent testing firm will take a minimum of three (3) test cylinders, one slump test and one entrained air test for each 20 m^3 placed or portion thereof for

a project having more than 20 m^3 of masonry concrete and for each 10 m^3 placed or portion thereof for a project having less than 20 m^3 and not less than one (1) test in any one day of concrete placed.

.3 Reject and do not place job site-mixed masonry concrete over 1.5 hours from mixing time.

1.11 INSPECTION AND TESTING OF GROUT

.1 The Contractor is to ensure all grout is tested by a testing firm certified in accordance with CSA-A283.

.2 An independent testing firm will be retained and paid for by The Contractor and approved by the Owner's Representative in accordance with Section 01 40 00 of these specifications.

.3 The Contractor is responsible to test all grout to ensure grout work conforms to the requirements of the Contract Documents.

.4 The independent testing firm will test one set of cubes with a minimum of six (6) cubes for each day's production on all types of grout used in accordance with ASTM C109.

1.12 INSPECTION AND TESTING OF TOPPING OR BENCHING BOND

.1 The Contractor is to ensure the tensile bond between topping and substrate is tested by a certified testing firm.

.2 An independent testing firm will be retained and paid for by The Contractor and approved by the Owner's Representative in accordance with Section 01 40 00 of these specifications.

.3 The Contractor is responsible to test all bond strength to ensure bond strength conforms to the requirements of the Contract Documents.

.4 Test bond strength in accordance with CSA Test Method A23.2-6B.

.5 The independent testing firm will test bond strength at a frequency of one test for each 200 m^2 or less of area.

1.13 ACCEPTABILITY

.1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.

.2 Strength evaluation tests and analysis:

.1 The Owner's Representative may order an independent testing firm to obtain cores, x-rays or similar non-destructive tests where evidence points to a potentially deficient structure.

.2 The Owner's Representative may order a load test and/or analysis, as defined by CSA-A23.3, if the non-destructive tests are impractical or inconclusive.

.3 Pay all costs for the evaluation tests and additional Engineering analysis required:

.1 To demonstrate the adequacy of a structure that does not meet the requirements of these specifications or the drawings.

.2 For a structure that has been placed before formwork and reinforcing have been made available for review by the Owner's Representative.

.4 Reinforce by additional construction or replace as directed by the Owner's Representative at Contractor's expense concrete that is judged inadequate by structural analysis or by results of load tests.

.5 Revise mix design proportions as required for the remainder of the work.

.6 The Owner's Representative may order further additional testing to the above at any time even though the required tests indicate that the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements, and the Contractor will pay for those that do not.

.7 Concrete in place not meeting air content or slump specifications as tested is to be replaced or protected by remedial measures to the satisfaction of the Owner's Representative at no cost to the Owner.

Part 2 Products

2.1 CEMENTING MATERIALS

.1 Portland cement: to CSA-A3001 Type GU normal Portland cement, Type MS moderate sulphate resistant. The cement is not to contain a total sodium oxide equivalent more than 0.6% by mass.

2.2 SUPPLEMENTARY CEMENTING MATERIAL

.1 Fly ash is to be a Type F or Type CI pozzolan and is to meet the requirements identified in CSA-A3001.

2.3 AGGREGATES

.1 For all concrete mix types, the fine aggregates are to conform to the requirements identified in CSA-A23.1 for the specified exposure class.

.2 For all concrete mix types, the coarse aggregates are to conform to the requirements identified in CSA-A23.1 for the specified exposure class. The aggregates are to meet the Group 1 gradation requirements listed in CSA-A23.1.

.3 The source of the aggregates and the method of manufacture or production, including the type of equipment used, is not to be altered for the duration of the project following the acceptance of the aggregates unless a new source is approved and accepted by the Owner's Representative as per requirements of this section.

2.4 WATER

.1 Water for use in concrete production and curing is to be clean and free from injurious amounts of oil, acid, alkali, soluble chlorides, organic matter, sediment, or any other deleterious substances as per CSA-A23.1.

2.5 ADMIXTURES

.1 Air-entraining admixtures are to conform to the requirements of ASTM C260. The admixture is to be of uniform consistency and quality within each container and from shipment to shipment.

.2 Water-reducing admixtures are to conform to the requirements of ASTM C494, Type A or D. The admixture is to be of uniform consistency and quality within each container and from shipment to shipment.

.3 Superplasticizers, if approved by the Owner's Representative, (high-range water reducers) are to conform to the requirements of ASTM C494, Type F or G.

2.6 CONCRETE MIXES

.1 Design all concrete mixes and pay for all costs associated with the development of the mix designs. Ensure the mix designs provide adequate protection against AAR deterioration as per provisions of CSA A23.2 Method 27A.

.2 Supply concrete in accordance with CSA-A23.1, Clause 16, Table 13, Alternative 1, except that the additional requirements of this specification are also to apply.

.3 Use only such materials or blends of materials that will result in a uniform colour of exposed surfaces.

.4 Design concrete mixes that will be placed by concrete pump for pumping.

.5 In the event that slump and/or air content are outside the specified tolerance range as determined by the inspection and testing firm appointed by The Owner, the Owner's Representative may, at his sole discretion, accept a proposal for one adjustment of the deficient condition as an alternate to rejection.

.6 In the case of concrete mixes with superplasticiers, the Contractor will be allowed to adjust only the quantities of superplasticizers and air entrainment agent. Addition of water to the batch will not be permitted. In no case will approved batch adjustment relieve the Contractor of responsibility for the eventual durability, strength and acceptability of the concrete concerned. The Owner's Representative reserves the right to reject any batch in the event of confirmed unacceptability and to require immediate removal of any concrete from this batch that has already been placed in the structure.

.7 Supply concrete in accordance with CSA-A23.1 with properties as noted in the following table:

Mix Type	Location	Specified Minimum Strength 28 day (MPa)	CSA Cement Type [1]	Maximum Water/Cem. Mat. Ratio	Maximum Fly Ash Content (% of Tot. Cem. Mat)	CSA Exposure Class	Maximum Aggregate Size (mm)	Water Slump [2]		Air Content%	Curing Types [3] [4]
								Min. (mm)	Max. (mm)		
Type A	Masonry fill	20	GU	-	20%	N	10	160	200	-	1
Type B	Exterior Slabs on Grade	35	MS	0.40	25%	C1	20	60	100	5 to 8	1
Type C	Water Retaining Structures	30	MS	0.40		F1	20	60	100	4 to 7	3
Type D	Foundation footings, walls	25	GU	0.55	25%	F2	20	60	100	4 to 7	1
Type E	Underside duct, enclosure/fill	10	GU	0.55	25%	N	20	60	100	-	1

Notes:

1. MS = Type 20; GU = Type 10 Portland Cement.
2. Chemical slump (Slump after adding Superplasticizer) is not to be greater than 180 mm.
3. Curing and Protection. See specifications for Types. Use Type 3 curing for all concrete with greater than 30% fly ash.

.8 Aggregate size specified is the maximum nominal size.

.9 Cement: Use Type GU and MS for all concrete.

.10 Minimum cement content :

.1 350 kg/m^3 for watertight or liquid-retaining structures.

.2 335 kg/m^3 for all concrete subjected to deicing salts and freeze thaw exposure.

.11 Fly Ash:

.1 Concrete mixes with greater than 25% fly ash are not recommended for flatwork requiring a steel trowel finish or flatwork exposed to deicing salts and freeze-thaw.

.2 Concrete mixes with greater than 30% fly ash to be designed with a substantial reduction in water.

.12 Slump: No slumps outside the range of maximum or minimum will be permitted without written permission of the Owner's Representative.

.13 Air Content: All mix types with exposure classifications to be air-entrained in accordance with the above table and CSA-A23.1.

.14 Use a water-reducing agent in all concrete.

.15 Do not change concrete mix proportions or source material for concrete without written approval of the Owner's Representative.

.16 Use only non-chloride based accelerating admixtures in cold weather only when approved by the Owner's Representative. If approved, the use of admixtures will not relax cold weather placement requirements.

.17 Do not use calcium chloride or admixtures containing calcium chloride in any concrete.

.18 Use set-retarding admixtures during hot weather with written approval of the Owner's Representative to prevent cold joints in concrete.

.19 Use all admixtures in strict accordance with the manufacturer's recommendations.

.20 Do not use non-specified admixtures unless approved in writing by the Owner's Representative. Where superplasticizers are thus approved, ensure mix designs are correctly adjusted for placement, strength, durability, and air content requirements.

.21 Documentation indicating the compatibility of the water reducing admixture, the air entraining admixture, the superplasticizing admixture (if any) and the Portland

cement and the supplementary cementing materials is to be submitted with the mix design for review by the Owner's Representative.

2.7 STORAGE AND HANDLING OF MATERIALS

.1 Cement and supplementary cementing materials proposed are to be stored in a suitable weather-tight building that will protect these materials from dampness. All cementing materials to be free from lumps always during use in the work. All cementing materials stored for a length of time resulting in the hardening or formation of lumps is not to be used in the Work.

.2 All aggregates are to be handled to prevent segregation and to obtain uniformity of materials. The separated aggregates and the aggregates secured from different sources are to be piled in separate stockpiles. The site of the stockpiles is to be cleaned of all foreign materials and is to be reasonably level and firm. If the aggregates are placed directly on the ground, material is not to be removed from the stockpile within 150 mm of the ground level. This material is to remain undisturbed to avoid contaminating the aggregate with the ground material.

2.8 GROUT MIXES

.1 Epoxy grout: Non-shrink, high strength compound consisting of epoxy resins, hardeners, and non-metallic aggregate for exterior use. Pre-mixed in strict accordance with the manufacturer's instructions to obtain a minimum compressive strength of 100 MPa in 28 days.

.2 Dry pack grout: Non-shrink compound consisting of non-metallic aggregate and water. Mixed with sufficient water for the mixture to make a sound, solid pack and capable of developing compressive strength of 35 MPa at 28 days.

.3 Non-shrink grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents. Pre-mixed in strict accordance with the Manufacturer's instructions to obtain a minimum compressive strength of 16 MPa in 24 hours and 50 MPa in 28 days. Acceptable non-shrink grouts:

.1 Masterflow 713 Grout.
.2 Master Builders Set Non-Shrink Grout.
.3 Sika Grout 212.
.4 CPD Non-Shrink Grout.
.5 Sonogrout.

2.9 CONCRETE CURING

.1 Liquid membrane-forming curing compound: To ASTM C309. Must be compatible with dustproofing and hardening agents, floor hardeners and any sealers or waterproofing used.

.2 Membrane Curing Compound - Sealtight 1220, white pigmented curing compound by Meadows.

.3 Monomolecular Film – Confilm by Master Builders Technologies. Use mixture of one-part Confilm to five parts water.

2.10 HARDENERS

.1 Non-metallic Surface Hardener: To provide a high strength; high impact, abrasion and slip resistant finish, for medium duty traffic conditions. Pre-mixed for a dry shake application using Portland cement and mineral aggregates with a MOH hardness of not less than 7 to produce a minimum compressive strength of 50 MPa. Colour to be concrete grey. Acceptable non-metallic hardeners:

.1 Sika Durag Premium

.2 Target Synthetic Floor Hardener

.2 Use non-metallic surface hardener for top surface of all floor slabs of Service Areas, Pumphouses, Tunnels and Lower Levels.

.3 Apply surface hardeners in strict accordance with the manufacturer's recommendations and cure concrete as specified herein.

.4 Do not use surface hardeners on concrete with air entrainment contents greater than 3%.

.5 Follow the manufacturer's recommendations when using surface hardeners on concrete containing fly ash or slag.

2.11 SEALERS:

.1 Silane Floor Sealer: Cappar Capseal U, Masterseal SL silane sealers containing a minimum of 40% solids by weight. Use on exterior exposed slabs.

.2 Sealer for all concrete stairs: Acceptable Products:

.1 Ashford Formula as manufactured by Curecrete Chemical Company Inc. and distributed by Duracon Consulting Inc.

.2 Seal Hard as manufactured by L&M Construction Chemicals Inc.

.3 Shur-Seal as manufactured by Paul M. Wolff Co and distributed by Star Industrial Floors.

.4 Federal Formula as manufactured by Federal Flooring Division of Valspar Corporation.

2.12 SANDBLASTING

.1 Sandblast sand: Fine granular material, hard, strong durable mineral particles conforming to CSA-A179.

.2 Sandblast equipment: Capable of delivering 5.6 m^3 of free air at 0.69 MPa pressure, complete with filters, hoses and nozzles that can be regulated to ensure an even finish as approved by the Owner's Representative.

2.13 CRACK INJECTION

.1 Epoxy for crack injection: shall be a two-component, moisture insensitive, high modulus, injection grade, 100 percent solids, blend of epoxy-resin compounds. The consistency shall be as required to achieve complete penetration in hairline cracks and larger. Material shall conform to ASTM C881 Type 1 Grade 1. Acceptable products include Sika Corporation "Sikadur 2"; Adhesives Technology Corporation "Crackbond SLV302"; or equal. Epoxy grout shall be used for all crack repairs except as noted below for non-structural cracks in liquid-containing concrete. The Engineer shall determine whether a crack is classified as structural or non-structural. Structural cracks must be repaired with epoxy.

.2 Chemical grout for crack injection: Chemical (hydrophobic polyurethane) grout shall be used at the Engineer's discretion as an alternative to the injection of the epoxy grout for sealing non-structural cracks in structures intended to be watertight. Acceptable products include "Hydro Active Cut" by De Neef Construction Chemicals or SikaFix HH by Sika Corporation, or equal approved by the Engineer.

Part 3 Execution

3.1 GENERAL

.1 Perform cast-in-place concrete work in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.

3.2 PLACING CONCRETE

.1 Notify Owner's Representative and independent testing firm a minimum of 24 hours prior to commencement of any concrete placement. Allow time for corrective work for areas of unusual formwork and congested reinforcement.

.2 Notify independent inspection and testing firm's geotechnical Engineer to inspect and verify all soil conditions and bearing pressures of all foundations prior to placing concrete for mudslabs or foundations.

.3 Do not place concrete against frozen ground, frozen concrete, or frosted forms.

.4 Place concrete in accordance with CSA-A23.1 and as specified herein.

.5 In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and set solidly with non-shrink grout or as specified on the drawings. The holes for the inserts are to be thoroughly cleaned.

.6 Ensure all hardware and all other items to be cast into concrete are placed securely and will not cause undue hardship in placing concrete.

.7 Ensure all waterstops are securely fastened to concrete or securely wired to reinforcing to prevent misalignment, folding or movement during concrete placement. Maintaining the integrity and correct position of waterstops is critical to the performance of the structure.

.8 When placing concrete by pumping, grout or mortar used to lubricate the pump is to be wasted and not allowed to be placed into forms.

.9 Placing Concrete at Expansion Joints:

.1 Ensure joints are properly dimensioned and prepared as indicated on drawings.

.10 Placing Concrete at Construction Joints:

.1 Ensure joints are properly dimensioned and prepared as indicated on drawings, in accordance with A23.1 Clause 23.4 and as specified herein.

.2 Previously placed concrete surfaces are to be roughened to hard sound concrete and cleaned as soon as possible after placing concrete or stripping forms and properly cured. Do not use acid to clean substrate.

.3 After reinforcement and accessories are in place and prior to placing final forms, soak existing concrete surface for 12 hours or sufficiently long to obtain a saturated condition.

.4 Immediately prior to placing concrete remove excess water from existing concrete to obtain a saturated surface-dry condition and immediately apply cementitious waterproofing.

.5 For vertical joints of slabs, immediately scrub in the approved grout bonding system to the existing concrete surface as per CSA A23.1 and before the grout stiffens place concrete. Do not use plain latex as the bonding system.

.6 Vertical construction joints of walls can be constructed without the grout bonding system; however, the cementitious waterproofing is to be used.

.7 For horizontal walls: immediately place final forms followed by placing a thin cushion of structurally compatible grout, as per CSA A23.1, and then immediately followed by concrete placement.

.11 Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints and other critical items are not disturbed during concrete placement.

.12 Revise, re-seat and correct improperly positioned reinforcing hardware and other embedded items immediately before concrete placement.

.13 Ensure specified concrete cover around reinforcing is maintained.

.14 Do not place concrete older than 2 hours from batch time.

.15 Do not add water after batching unless in strict accordance with CSA-A23.1, Clause 18.4.3 and such that concrete conforms with the specified mix design parameters.

.16 Place concrete and screed in accordance with the lines and levels indicated on the drawings. Note special finish concrete tolerances indicated on the drawings.

.17 Place concrete in approximate horizontal layers such that each lift can be vibrated into the previous lift.

.18 Maximum vertical free fall of concrete is not to exceed 1200 mm in unexposed work or 800 mm in exposed work or in liquid retaining structures. Confine concrete with a suitable vertical drop pipe to prevent segregation.

.19 Place concrete directly into its final position in forms. Do not spread concrete with vibrators.

.20 Compact concrete thoroughly by mechanical vibrators. Ensure concrete is worked around reinforcement, embedded items and into all areas and corners of forms.

.21 Use internal vibrators in all sections that are sufficiently large, and supplement with external type if satisfactory surfaces can not be obtained.

.22 Check and re-adjust formwork to required lines and levels during placement of concrete.

.23 Place concrete as a continuous operation, stopping only at construction joints.

.24 Allow a minimum of three days between adjacent concrete placements.

.25 Place concrete in liquid-retaining structures with extreme care and extra effort.

.26 Consolidate and screed floors and slabs on grade level in accordance with CSA-A23.1, Clause 22, maintaining surface flatness as required for final floor finish. Pitch to drains 20 mm per meter nominal or as indicated on the drawings.

.27 Place building slabs on grade as one continuous placement between construction joints indicated on drawings. Sawcut control joints for each placement by sawing a continuous minimum 25mm deep slot, and at least 1/3 of the slab thickness at maximum 4.5 m centres each way unless otherwise indicated on the drawings. Sawcut as soon as the concrete has sufficiently hardened to prevent ravelling of the edges, but in no case later than 24 hours after the concrete has been placed.

.28 Use cold weather concreting methods in accordance with CSA-A23.1, Clause 21 when the mean daily temperature falls below 5°C, and use hot weather methods when the mean temperature rises above 25°C.

.29 Maintain accurate records of concrete placement. Record date, location of placement, quantity, air temperature and test samples taken. Make records available on request.

3.3 PLACING OF EXPOSED CONCRETE WALLS

.1 Limit length of concrete placement to prevent cold joints.

.2 Do not place concrete from one end for full height of placement.

.3 Use sufficient vibration equipment and methods to ensure dense, smooth concrete lines and surfaces free from bugholes, honeycombs and cold joints.

.4 Ensure vibrator penetrates each layer of fresh concrete to prevent stratification.

.5 In hot weather, use set retarding agents to prevent cold joints with permission of the Owner's Representative.

3.4 SEPARATE CONCRETE TOPPINGS AND BENCHING

.1 Prepare surface of previously placed concrete substrate in accordance with CSA-A23.1 to create a roughened surface for adequate bond, except do not use acid for surface preparation of the substrate. Remove any loosened or delaminated concrete.

.2 Remove all dust from the prepared surface by first using water then vacuuming after the surface is dry.

.3 Contact the Owner's Representative for inspection of the prepared surface immediately prior to application of the bonding system.

.4 Thoroughly saturate the concrete substrate with clean water for a minimum of 12 hours and allow to surface-dry. Remove any standing water after saturation period.

.5 Apply the approved bonding system to the substrate in accordance with the provisions of CSA-A23.1. Do not use latex in the bonding system.

.6 Place concrete topping or benching to required lines and levels indicated on drawings to a tolerance of +5 mm to -0 mm. Place within timing per bonding agent's manufacturer's instructions. Refer to drawing for special concrete tolerances.

.7 Start placement of topping at centre and work to outside in 300 mm sections at a time.

.8 Finish and moist-cure topping or benching as specified in other clauses. Any joints in the substrate are to be matched in the topping.

.9 The tensile bond strength between topping and substrate is to be minimum 0.9 MPa at 28 days as tested in accordance with CSA Test Method A23.2-6B.

3.5 FINISHING FLATWORK

.1 Finish flatwork in accordance with timing and procedures outlined in CSA-A23.1.

.2 Flatness and levelness to be in accordance with CSA-A23.1, Table 19, Class A for liquid retaining structures. Refer to drawings for special concrete tolerances.

.3 Scratch finish: For all concrete slabs to receive a bonded topping or benching, final finish surface to produce 5 mm deep, closely spaced grooves to a true plane not exceeding a 10 mm gap under a three-metre straight edge placed in any direction.

.4 Float Finish: For all concrete slabs to receive insulation board, waterproof membrane, or cementitious waterproofing, final finish surface with a power float to a true plane not exceeding a 10 mm gap under a three-metre straight edge placed in any direction.

.5 Steel Trowel: For all concrete slabs to be left exposed, to receive carpet, V.A. tile, quarry tile, resilient flooring, final finish surface with a power trowel to a true plane not exceeding a 5 mm gap under a three-metre straight edge placed in any direction.

.6 Concrete slabs in liquid retaining structures including topping and benching with air entrainment: Float finish followed by hand steel trowel to a true plane not exceeding 5- or 10-mm gap under a three-meter straight edge placed in any direction. Do not overwork surface to prevent scaling. Do not power float or power trowel. Do not commence finishing until all bleed water has evaporated.

.7 Concrete slabs to be used for vehicle and pedestrian traffic: Rough finish surface by floating manually to the specified slope, ensuring positive slope into all drains. Do not overwork surface to prevent scaling. Do not power float or power trowel. Finish surface to a medium broom finish. Do not commence finishing until all bleed water has evaporated.

.8 Broomed Finish: For all exterior concrete slabs to have non-slip surfaces, final finish surface after trowelling with fine broom finish.

.9 Repair all surfaces with unacceptable finishes or excessive variation by grinding and/or filling as approved by the Owner’s Representative at Contractor’s expense.

.10 Floor Hardeners: Apply in strict accordance with the manufacturer’s recommendations to surface of all slabs.

3.6 CURING AND PROTECTION

.1 Moist cure and protect concrete in general accordance with CSA-A23.1, Clause 21, and as stated in this specification. Curing is to begin immediately after the completion of the placing and finishing operation. Curing process is to provide the moisture and temperature conditions for a period necessary to develop strength, durability, and other required properties. The minimum curing requirements for the concrete are stated in the clauses that follow.

.2 Basic Curing, Type 1: Moist cure at a minimum temperature of 10°C for three (3) days or for the time required to obtain 40% of the specified 28 days strength.

.3 Additional Curing, Type 2: Moist cure at a minimum temperature of 10°C for a total seven (7) days or for the time required to obtain 70% of the specified 28-day strength.

.4 Extended Curing, Type 3: Continuously moist cure (concrete surfaces not allowed to dry) at a minimum temperature of 10°C for a minimum total of ten (10) days. All formed structures requiring the extended curing are to be kept in forms for a minimum of three (3) days. After removal of forms, curing for the remaining seven (7) days is to consist of a combination of the acceptable extended curing methods.

.5 Protect concrete from sudden temperature changes as noted in CSA-A23.1.

.6 Acceptable Basic or Additional curing methods: Curing Types 1 and 2:

- .1 Ponding or continuous sprinkling.
- .2 Absorptive mat or fabric kept continuously wet.
- .3 Curing compounds approved by the Owner's Representative for type and rate of application.
- .4 Waterproof paper or plastic film.
- .5 Non-absorptive and watertight forms left in contact with concrete. Wood forms are not considered watertight unless coated or sealed to prevent moisture absorption.
- .6 Other moisture-retaining method approved by the Owner's Representative.

.7 Acceptable Extended curing methods: Curing Type 3

- .1 Ponding or continuous sprinkling.
- .2 Absorptive mat or fabric kept continuously wet.
- .3 Non-absorptive and watertight forms left in contact with concrete. Wood forms are not considered watertight unless coated or sealed to prevent moisture absorption.
- .4 Other moisture-retaining method approved by the Owner's Representative.

.5 Membrane curing compound, Sealtight 1220 applied within one (1) hour of form removal or discontinuing of other approved curing method, at a rate of four (4) sq. m/litre.

.8 Where curing compounds are approved, apply in two applications at right angles to each other.

.9 Do not use curing compounds on concrete surfaces to receive topping, hardener, sealer or other type of bonded finish unless approved by the Owner's Representative. Confirm that the coatings and curing compound are compatible.

.10 Protect freshly placed and consolidated concrete against damage or defacement from curing methods or adverse weather conditions.

.11 Exterior concrete to be properly cured and protected and allowed to air dry for 30 days prior to application of de-icing chemicals.

.12 Exposed concrete walking surfaces not to receive an integral hardener: Coat with curing compound of type that provides permanent seal.

.13 During hot weather, begin curing process immediately after finishing. Use continuous water application or absorptive mats.

.14 No concreting is to be allowed until all materials required for the curing and protection phase are on site and ready for use.

3.7 DEFECTIVE CONCRETE

.1 Immediately after removing forms, all concrete surfaces are to be inspected. Report any imperfect joints, voids, stone pockets and other defective areas to the Owner's Representative at once and repair before the concrete is thoroughly dry. Defective areas are to be chipped away to a depth of not less than 25 mm past the defective concrete with the edges perpendicular to the surface. The area to be repaired and a space of at least 150 mm wide surrounding it are to be wetted to a saturated surface-dry condition to prevent absorption of water from the repair material.

.2 All defective concrete surfaces shall be reviewed by the Owner's Representative prior to the application of repair material to ensure all defective concrete was removed and that the surfaces are repaired as specified in clause 3.7.1.

.3 The repair is to be made of the same material and of the same proportions as used for the concrete, except that the coarse aggregate is to be omitted and cement added to match the colour of the surrounding concrete. The amount of mixing water is to be as little as consistent with the requirements for handling and placing. The mortar is to be re-tempered without the addition of water by allowing it to stand for a period of one hour, during which time it is to be mixed with a trowel to prevent setting.

.4 The repair material is to be thoroughly compacted into place and screeded off to leave the repair slightly higher than the surrounding surface. It is then to be left undisturbed for a period of one to two hours to permit initial shrinkage before being finally finished. The repair is then to be finished to match the adjoining surface and cured to the requirements noted in this specification.

.5 Watertight structures with honeycombing or embedded debris are not acceptable. Remove and replace concrete between construction joints.

.6 Report any shapes and lines outside the specified tolerances and repair or correct as directed by the Owner's Representative.

3.8 FINISHING FORMED SURFACES

.1 Finish concrete in accordance with CSA-A23.1. Ensure all concrete finishes are uniform.

.2 Rough-Form Finish: Concrete surfaces not exposed to view including exterior wall surfaces of liquid-retaining structures below grade. Seal tie holes with non-shrink grout or where concrete is to be watertight with cementitious waterproofing, repair defects and remove fins exceeding 5 mm.

.3 Smooth-Form Finish: Horizontal concrete surfaces exposed to view including ceilings and soffits. Surfaces to be smooth, hard, and uniform texture free from raised grain, torn surfaces, worn edges, patches, dents or other defects impairing the texture. Seal tie holes with non-shrink grout or where concrete is to be watertight with cementitious waterproofing, repair defects and remove all fins.

.4 Sack-Rubbed Finish: Vertical concrete surfaces exposed to view unless sandblasted. Sack-rubbed finish required at all interior wall surfaces of liquid-retaining structures. Seal tie holes with non-shrink grout or where concrete is to be watertight use cementitious waterproofing, repair defects and remove all fins. Rub saturated surface with premixed mortar using clean burlap pads in strict accordance with CSA-A23.1 by an experienced person to fill all surface voids for a smooth, even, uniform finish.

.5 Do not parge.

.6 Waterproofed Surfaces Form Finish: Waterproofed Surfaces Form Finish: Concrete surfaces to be waterproofed. Surfaces to have an open capillary system prepared in accordance with the requirements of the manufacturer of waterproofing. Surfaces to be free from raised grain, torn surfaces, worn edges, patches, dents or other defects impairing the application of effectiveness of the waterproofing. Seal tie holes with cementitious waterproofing, repair defects as recommended by the manufacturer of waterproofing and remove all fins.

3.9 SURFACING AND FINISHING

.1 Surface finishes are to be classified as follows:

.1 Class 1: Ordinary surface finish.

.2 Class 2: Sack rubbed finish.

.3 Class 3: Floated surface finish.

.4 Class 4: Trowel finish.

.5 Class 5: Broomed finish.

.6 Class 6: Sandblast finish.

.2 All formed surfaces are to receive as a minimum a Class 1 finish. Other finishes are to be as indicated in the specifications.

.3 Class 1 - Ordinary surface finish:

.1 Immediately following the removal of forms, all fins and irregular projections are to be removed from all surfaces except from those that are not to be exposed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges and other defects are to be thoroughly cleaned, and after having been kept saturated with water for a period of not less than three hours, it is to be carefully pointed and trued with mortar of cement and fine aggregate mixed in the portions used in the grade of concrete being finished. Mortar used in pointing is not to be more than one hour old. The mortar patches are to be cured as specified under “Curing”. All construction and expansion joints in the completed work are to be left carefully tooled and free from all mortar and concrete. The joint filler is to be left exposed for its full length and with clean and true edges.

.2 The resulting surfaces are to be true and uniform. All surfaces that cannot be repaired to the satisfaction of the Owner’s Representative are to be rubbed as specified for Class 2 – Sack rubbed finish.

.4 Class 2 – Sack rubbed finish: Required for exposed surfaces unless sandblasted:

.1 After removal of forms, the rubbing of concrete is to be started as soon as conditions permit. Immediately before starting this work, the concrete is to be kept thoroughly saturated with water for a minimum period of three (3) hours. Sufficient time is to have elapsed before the wetting down to allow the mortar used in pointing of defects to thoroughly set. Surfaces to be finished are to be rubbed with a medium coarse carborundum stone using a small amount of mortar on its face. The mortar used is to be composed of cement and fine sand fixed in the proportion used in the concrete being finished. Rubbing is to be continued until all the form marks, projections and irregularities have been removed, all voids have been filled and a uniform surface has been obtained. The paste produced by this rubbing is to be left in place at this time.

.2 After concrete above the surfaces being treated has been cast, the final finish is to be obtained by rubbing with a fine carborundum stone and water. This rubbing is to be continued until the entire surface is of a smooth texture and uniform colour.

.3 After the final rubbing is completed and the surface has dried, it is to be rubbed with burlap to remove loose powder and left fee from all unsound patches, paste, powder and objectionable marks.

.5 Class 3 - Floated surface finish: Required for all unexposed top surfaces.

.1 After the concrete has been compacted, the surface is to be carefully rodded and struck off with a strike board to conform to the cross-section and grade shown on the drawings. Proper allowance is to be made for camber if required. The strike board can be operated longitudinally or transversely and is to be moved forward with a combined longitudinal and

transverse motion, the manipulation being such that neither end is raised from the side forms during the process. A slight excess of concrete is to be kept in front of the cutting edge at all times.

.2 After striking off and consolidating, the surface is to be made uniform by longitudinal or transverse floating or both.

.3 After floating has been completed and the excess water removed, but while the concrete is still plastic, the surface is to be tested for trueness with a straight edge. Any depression found is to be immediately filled with fresh mixed concrete, struck off, consolidated and refinished. High areas are to be cut down and refinished. The final surface is to conform to the required grade and contour such that the deviation is not greater than 6 mm under a 3 m straight edge.

.6 Class 4 - Trowel finish: Required for all exposed top surfaces that are not to receive a broomed finish.

.1 After the concrete has been deposited in place, it is to be compacted and the surface struck off by means of a strike board. The surface is to be made uniform, dense and free from voids by wood trowel floating. When the concrete has hardened sufficiently, the surface is not to vary by more than 3 mm under a 3 m straight edge.

.2 It is then to be trowelled to a smooth, dense finish using a steel trowel.

.7 Class 5 - Broomed finish: Required for sidewalk and walkway surfaces and approach slabs.

.1 After the concrete has been deposited in place, it is to be compacted and the surface struck off by means of a strike board. The surface is to be made uniform, dense and free from voids by wood trowel floating. When the concrete has hardened sufficiently, the surface is not to vary by more than 3 mm under a 3 m straight edge.

.2 When the concrete has hardened sufficiently, the surface is to be given a broomed finish. The strokes of the broom are to be square across the slab with adjacent strokes slightly overlapped to produce regular corrugations not over 3 mm in depth.

.3 Sidewalk surfaces are to be laid out in blocks with an approved grooving tool as shown on the drawings or as directed by the Owner's Representative. An edging tool is to be used along all edges of the sidewalks.

.8 Class 6 - Sandblast finish: Required to roughen construction joints, to prepare and clean surfaces to receive waterproofing or sealers or finish exposed surfaces as indicated on the drawings.

.1 A medium sandblast finish for exposed finished surfaces. This finish is intended to give a uniform texture to the concrete but not to expose the coarse aggregate.

.2 Prior to applying a sandblast finish, prepare test panels on concrete that is to be backfilled or not exposed. No sandblasting is to be done until

such time as the test panels meet with the satisfaction of the Owner's Representative as to texture and conformity.

3.10 GROUT

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

.2 Install epoxy grout in all exterior handrail, davit, and equipment base plates during erection.

.3 Install dry pack grout as required under column and beam base plates.

.4 Install non-shrink grout as required under columns, beams, and equipment pads, and for doweling to existing concrete.

3.11 SEALERS

.1 Silane sealer: To be applied by an approved applicator competent in application of sealers in strict accordance with the manufacturer's recommendations and directions. Apply Capseal U at a rate of 284 ml/m^2 and Masterseal SL at a rate of 222 ml/m^2.

3.12 JOINT SEALANTS

.1 Refer to Section 07 92 00 for Joint Sealants.

.2 Seal base of all form tie holes in exposed concrete surfaces using non-shrink grout or cementitious waterproofing.

.3 Place cementitious waterproofing in below-grade and liquid retaining structure wall construction joint reglets.

3.13 SANDBLASTING

.1 Conform to the requirements of the Portland Cement Association for sandblasting of concrete surfaces.

.2 Use only competent and qualified workers experienced in sandblasting techniques with adequate plant and equipment.

.3 Protect from damage all surfaces not scheduled for sandblast finish. Make good any damaged surfaces to the satisfaction of the Owner's Representative.

.4 Hoard around work area and prevent air-borne products from contaminating or damaging new construction or other existing work.

.5 Apply the sandblast finish to a designated area of concrete surface. Match the approved sample panel. This sample area is to be done in the presence of the

Owner's Representative, and the approval is to be given prior to the continuance of the work. The entire sandblasted surface is to match this approved sample area.

.6 Schedule sandblasting operations with placement of concrete so that the most economical procedures can be used, and the desired finish attained with minimum interference with other trades.

3.14 EXTERNAL FASTENING AND CORING

.1 Do not core concrete without prior written approval of the Owner's Representative.

.2 Do not drill inserts or drive power actuated fasteners into structural concrete without prior written approval of the Owner's Representative.

3.15 CARBON MONOXIDE PRODUCING EQUIPMENT

.1 Do not place concrete for floor slabs if carbon monoxide producing equipment has been in operation in the building or temporary enclosure during the 12 hours preceding the start of concreting.

.2 Provide positive ventilation during the 12 hours preceding the start of concreting.

.3 Do not operate carbon monoxide producing equipment in the building or temporary enclosure during or within 24 hours after completing the finishing of any floor slab section. If necessary, provide adequate provisions to exhaust all carbon monoxide outside the enclosure.

3.16 CLEANING

.1 Repair, remove and clean all drips and smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

.2 Hose down sandblasted surfaces. Brush thoroughly with a stiff broom to remove all dust and loose particles.

3.17 DISINFECTION

.1 Equipment Supplied by the Contractor:

.1 All equipment and material required for testing, flushing and disinfection shall be supplied by the Contractor as part of the Work. This includes water for testing, flushing and disinfection.

.2 Chlorine

.1 Use liquid chlorine, sodium hypochlorite or calcium hypochlorite

.2 Refer to AWWA-B300 and B301 Standards for Hypochlorites and Liquid Chlorine.

.3 Water

.1 Water for hydrostatic testing and for flushing reservoirs and other structures in the waterworks system shall be clean potable water.

.2 Water for hydrostatic testing and flushing of structures, which will not contain potable water shall be clean water, not containing chemicals or any substances likely to harm the Work.

.4 Safety

.1 The toxicity of any product should be investigated by the Contractor. The need for ventilation when installing and required protective equipment, such as gloves, goggles, and masks, should also be checked prior to application.

.5 Disinfection Procedure

.1 Disinfection shall be in accordance with AWWA-C652 Disinfection of Water Storage Facilities. (For disinfection of water treatment plants and wells, refer to AWWA Standard C653 and C654, respectively.)

.2 Use AWWA Chlorination Method #1, #2 or #3 and submit details of proposed Method to the Engineer for approval.

.3 Water shall be dechlorinated prior to release. Use dechlorination manhole filled with sodium thiosulfate sacks for the purpose of water release and dechlorination. Control the release rate by keeping drain valves partially closed. The Contractor shall provide a monitor during non-working hours to observe the release of water.

.4 Release of chlorinated water will not be allowed.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Provide and install all miscellaneous metal shown or otherwise described on Contract Drawings including stairs, railings, frames, etc. Contractor to note that some steel may require removal and reattachment during construction.

1.2 REFERENCE STANDARDS

.1 Perform miscellaneous metal work in accordance with the following standards, except where specified otherwise.

.2 Provide one copy on site of the first two standards listed below.

.1 BCBC 2012, British Columbia Building Code.

.2 CSA-G40.20-04, General Requirements for Rolled or Welded Structural Quality Steels.

.3 CSA-G40.21-04, Structural Quality Steels.

.4 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 CAN/CSA-S16.1, Limit States Design of Steel Structures.

.6 CSA-W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA-W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

.8 CSA-W59.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.9 CSA-W178.1-08, Certification of Welding Inspection Organizations.

.10 CSA-W178.2-08, Certification of Welding Inspectors.

.11 CSA-W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

.12 CSA-W55.3-08, Certification of companies for resistance welding of steel and aluminum.

.13 CSA-W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.14 ASTM A108-07, Specification for Standard Quality Cold Finished Carbon Steel Bars.

.15 ASTM A193, Specification for Alloy-Steel and Stainless-Steel Bolting Material for High-Temperature Service.

.16 ASTM A194/A194M-08b, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.

.17 ASTM A325-09, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa ksi Minimum Tensile Strength.

.18 ASTM A449, Standard Specification for Quenched and Tempered Steel Bolts and Studs.

.19 ASTM A563M-07, Standard Specification for Carbon and Alloy Steel Nuts [Metric].

.20 ASTM A563-07, Standard Specification for Carbon and Alloy Steel Nuts.

.21 ASTM A780-01 (R2006), Repair of Damaged Hot-Dipped Galvanized Coatings.

.22 CISC/CPMA 1-73a, Structural Steel One-Coat Paint.

.23 CISC/CPMA 2-75, Structural Steel Primer.

.24 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.

.25 CAN/CGSB-1.71, Inorganic Zinc Coating.

.26 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.27 SSPC SP2, Hand Tool Cleaning.

.28 SSPC SP5, White Metal Blast Cleaning.

.29 SSPC SP6, Commercial Blast Cleaning.

.30 SSPC SP7, Brush-Off Blast Cleaning.

1.3 REGULATIONS

.1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located and abide by the current laws and regulations regarding public safety.

.2 The codes and regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers' Compensation Board and other applicable acts administered by the authority having jurisdiction in the Province of British Columbia apply to the work of this section.

1.4 SAFETY

.1 Conform to good construction practice regarding safety.

.2 Carry out miscellaneous metal work in accordance with the British Columbia Building Code.

1.5 QUALIFICATIONS

.1 The organization undertaking to weld under this section is to be fully approved by the Canadian Welding Bureau under the requirements of CSA-W47.1, Certification of Companies for Fusion Welding of Steel Structures, Division 1 or 2.1 only, or CSA Standard W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members, or both, as applicable.

.2 Welding of steel is to be as per CSA-W59. Welding of aluminum to be as per CSA-W59.2.

.3 Welding Inspection: The organization undertaking to perform weld inspection under this section is to be fully approved by the Canadian Welding Bureau under the requirement of CSA-W178.

.4 Engage a professional Structural Engineer registered in the Province of British Columbia, fully qualified and experienced in the design of structural steel, connections, and welded components to be responsible for the design of specified steel components, connections, and welded components.

1.6 DESIGN

.1 Design components and connections in accordance with the BCBC and CAN/CSA-S16.1 to resist all loads indicated on the drawing or as specified.

.2 Except where members are specifically sized on the drawings, all stairs and landing sections, attachments and connections are to be designed to support a minimum live load of 4.8 kN/m^2.

.3 Connections:

.1 Connection Design: to CAN/CSA-S16 to resist all loads and forces shown on the Drawings and as noted below.

.2 Provide bolted or welded connections, unless shown otherwise on Drawings.

.3 Use high strength bolts, except that A325 bolts may be used for connections of roof purlins, bridging, girths, and trimmer beams not connecting to columns, unless otherwise noted on Drawings.

.4 Use slip resistant [friction–type] connections for bolted joints designed to resist reversible forces, impact loads, seismic or wind loads, crane loads, tension loads and oversized and slotted holes not designed for movement.

.4 Beam Connections:

.1 Design components and connections in accordance with CAN/CSA-S16.1 to resist all loads and forces shown on the drawings and as noted below.

.2 Design connections for wide flange beams, channel sections and horizontal hollow structural steel sections for a minimum force equal to one-half of the shear capacity of the web of the section with a minimum connection length of one-half the depth of the section.

.3 Provide flexible beam connections for unrestrained members in accordance with CSA S16.1, unless shown otherwise on Drawings.

.4 Select connections, wherever possible, from standard designs tabulated in current edition of CISC Handbook of Steel Construction, except that length of beam web angles are not to be less than half the depth of beam, and single angles are not to be used for beams deeper than 600 mm.

.5 Provide direct connections to flanges of spandrel beams for interior and exterior perimeter beams to restrain twisting but maintain flexibility in primary plane of bending.

.5 Bracing and stability systems shown on structural drawings are for stability of the completed structure and are not to be assumed as adequate for various stages of construction.

.6 Verification of design capacities by calculation to be made available to the Owner's Representative.

1.7 SUBMITTALS

.1 Submit in writing evidence of qualification for welding under CWB.

.2 Submit evidence of ability to weld reinforcing steel in accordance with CSA-W186.

.3 Submit design calculations sealed and signed by a professional Structural Engineer registered in the Province of British Columbia.

.4 Prior to commencing work, the Contractor's Engineer is to submit documentation showing evidence of registration in the province, plus qualifications and experience. The Contractor's Engineer is to further acknowledge in writing that he has reviewed the specifications and drawings and is aware that he is to inspect the fabrication and installation of work and certify the work at completion.

.5 Provide upon request copies of the following certificates

.1 Mill certificates, signed by manufacturer, certifying that products furnished comply with ASTM and CSA specifications in accordance with the contract requirements and with other requirements of the Contract Documents. A Certificate of Compliance will be acceptable where mill test reports are not available.

.2 Welding Certificates.

1.8 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Clearly indicate materials, components, core thicknesses, finishes, dimensions, connections, joints, method of anchorage, number of anchors, supports, reinforcement, fabrication and installation details and accessories.

.3 Clearly show all shop and erection details including cuts, copes, holes, and threaded fasteners.

.4 Clearly show all welds, both shop and field, by the currently recommended symbols of the Canadian Welding Bureau.

.5 Prepare Shop Drawings of all connections and components designed by the fabricator under the seal and signature of the Contractor's professional structural Engineer responsible for this design.

1.9 QUALITY CONTROL

.1 The Contractor's professional Engineer responsible for the design of connections and other components is to inspect the fabrication and erection of these components in accordance with APEGBC Guidelines

1.10 INSPECTION AND TESTING

1.1.1 The Contractor is to ensure materials and workmanship are inspected and tested by an inspection and testing firm certified in accordance with CSA W178.1, retained and paid for by the Contractor and approved by the Owner's Representative in accordance with Section 01 40 00 of these specifications.

.1 The Contractor is responsible to inspect and test materials and workmanship to ensure miscellaneous metals work conforms to the requirements of the Contract Documents.

.2 Provide casual labour and access for inspection to all places where work is being done or stockpiled.

.3 The inspection and testing firm will test 1 in 10 welds. Testing of welds to include visual examination of all welding procedures at the plant and in the field, plus magnetic particle, x-ray, or other means deemed necessary by the testing agency to permit certification of welds.

.4 The inspection and testing firm will inspect all bolts for all snug-tightened high-strength bolted connections.

.5 The inspection and testing firm will test all Nelson Studs.

.6 The inspection and testing firm will inspect surface preparation and cleaning for painted and galvanized steel.

.7 The inspection and testing firm will inspect and verify one coat paint, primer, zinc coat and galvanizing thickness.

.8 The Contractor is to inspect and test all miscellaneous metal work to ensure compliance with the Contract Documents.

.9 The Owner's Representative may request additional testing of welds and bolts to ascertain the full number of defects if the tests noted above indicate excessive deficiencies. Additional costs for extra testing to be borne by the Contractor.

.10 Contractor to pay for all costs for re-testing and re-inspection because of defective workmanship.

.11 Contractor to pay for all costs of repairs to correct defective work.

.12 The Contractor's inspection and testing firm is to submit to the Owner's Representative final reports certifying all welds and connections, including confirmation that required repairs have been completed. These reports to be submitted under the seal and signature of a professional Structural Engineer registered in the Province of British Columbia.

.13 Notify Owner's Representative and inspection and testing firm 24 hours prior to commencement of shop work for all testing and inspection.

1.11 ACCEPTABILITY

.1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.

.2 Additional testing, inspection and evaluation may be required where evidence points to a potentially deficient structure.

.3 Pay all costs for additional testing, inspection and analysis required to demonstrate the adequacy of a structure that does not meet the requirements of the Contract Documents.

.4 Reinforce by additional construction or replace as directed by the Owner's Representative at Contractor's expense all structure or material judged inadequate by structural analysis or by testing and inspection.

.5 The Owner's Representative may order further testing, inspection, and analysis at any time. In this instance, The Owner will pay for those tests, inspections or analysis that meet the specified requirements, and the Contractor will pay for those that do not.

1.12 HANDLING

.1 Use all means necessary to protect fabrications before, during and after installation.

.2 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative at no additional cost to the Owner.

1.13 PRODUCT DELIVERY AND STORAGE

.1 Schedule delivery of components to site to coincide with installation of Work.

.2 Store components to prevent damage and distortion.

.3 Protect finishes from scratches and soiling.

.4 Store materials in a safe, dry, above ground location.

.5 Prevent contact with material that may cause corrosion, discolouration, or staining.

1.14 COORDINATION WITH OTHER TRADES

.1 Supply necessary instructions, templates, and drawings to other trades for setting anchor bolts and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors that are embedded in concrete or masonry. Deliver such items to Project site in time for installation.

.2 Coordinate primer requirements with paint system specifications in Section 09900. Failure to apply the referenced primer will result in this Section removing the applied primer and re-coating with specified material at no additional cost to the Owner.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 Supply new materials, free from defects impairing strength, durability, or appearance, of the best commercial quality for purposes specified.

.2 Where metal fabrications are exposed to view in the completed work must have smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, manufacturer's stamps, or roughness.

.3 Structural steel members and plates: To CSA-G40.21 of Type W weldable steel. Minimum yield strength 350 MPa for hollow structural steel members, wide flange sections, channel sections and angles with legs 80 mm or greater; 300 MPa for plates.

.4 Structural steel angles with 80 mm legs or less: To CSA-G40.21 of Type W weldable steel. Minimum yield strength 300 MPa.

.5 Shear stud connections: Headed concrete anchors conforming to ASTM A108.

.6 Bolts and required nuts and washers: High strength type recommended for structural steel joints to ASTM A325, medium-carbon steel. Nuts for galvanized bolts to be A563 Grade DH or A194 Grade 2H.

.7 Anchor bolts as noted on the drawings to ASTM A193 and A449.

.8 Welding materials as per CSA-W59.

.9 Stainless steel: To ASTM A167 and ASTM A276, Type 316L as indicated on the drawings.

.10 Structural Aluminum: 6061-T6.

.11 Nut dimensions as per ASA B182 for heavy semi-finished hexagon nuts.

.12 For fastenings in stainless steel use stainless steel Type 316 ELC ASTM A167.

.13 All fasteners submerged in water or sewage: Stainless steel Type 316 ELC ASTM A167.

.14 Drilled adhesive anchors refer to Section 03 15 00.

.15 One-coat paint where no further painting is specified: Conform to CISC/CPMA 1.73a, Structural Steel One-Coat Paint.

.16 Primer where further painting is specified: Conform to CISC/CPMA 2-75, Structural Steel Primer.

.17 Primer: to CAN/CGSB-1.40 for interior locations, to CAN/CGSB-1.181 (zinc-rich) to exterior locations. Use shop primer compatible with primers and paints specified in Section 09 91 23 – Interior Painting.

.18 Shop and field studs to be Nelson headed type anchors with fluxed ends or approved equivalent. Sizes as detailed on drawings.

.19 Shop galvanizing: Hot dipped galvanizing with a minimum coating of 900 g/m^2 to CAN/CSA-G164.

2.2 CORROSION PROTECTION

.1 Conform to Section 09 91 23.

.2 Use stainless steel, aluminum or galvanized steel where indicated on Drawings.

2.3 SAFETY CHAINS

.1 Removable 5 mm proof chain 13 mm x 29 mm c/c oval shaped type 316 SS stainless steel links, snaphooks and eye unless noted otherwise.

2.4 STEEL LEDGE ANGLE AND LINTELS

.1 Fabricate and install steel ledger angles and lintels as detailed on the drawings and reviewed shop drawings, complete with anchors or bolts, as indicated.

.2 Fabricate and install steel ledger angles and lintels to withstand all superimposed loading.

.3 Install level and true to line.

2.5 STEEL FRAMING AROUND OPENINGS

.1 Fabricate steel plate and bent plate framing around openings, including around windows, doors louvers and the like, as detailed on the drawings and reviewed Shop Drawings.

.2 Coordinate installation of steel framing with doors, windows, louvres, and the like, to ensure openings are correctly sized.

.3 Install steel plate and bent plate framing to support doors, windows, louvers, and the like, and to withstand all superimposed loading.

2.6 BENT SHEET METAL FRAMING

.1 Fabricate and install 0.762 mm base metal thickness, Z275 galvanized sheet metal, continuous C channel framing to parapets on roof, and to ends of hollow core slabs as detailed on the drawings and reviewed shop drawings.

.2 Fabricate in minimum 2440 mm lengths. Butt joints together so that sections are flush and even with each other to provide a smooth flat surface to accept membranes, plywood, and finishes.

.3 Mechanically fasten channels to hollow core slabs with drilled anchors, of type to suit installation, with 2 anchors (one at each side of bottom leg of channel) at maximum 400 mm o.c., and to withstand all superimposed loading.

.4 Mechanically fasten C channel to face of hollow core slab ends and edges, to provide a smooth flat surface, ready to receive membrane and finishes.

2.7 ANCHOR BOLTS, LAG SCREWS, ETC.

.1 Provide anchor bolts, bolts, bolt washers and nuts, lag screws, expansion shields, toggles, straps, sleeves, brackets, etc., where required and where indicated.

2.8 MISCELLANEOUS FRAMING

.1 Refer to Drawings for miscellaneous metal items and embedded plates which are to be fabricated, supplied, and installed under this Section.

.2 Fabricate all other metal fabrication items or miscellaneous metal items required to complete the project.

2.9 HATCH COVERS

.1 Locate hatch covers where indicated on the drawings. Hatch sizes are identified on the Contract Drawings to match the existing arrangement. Coordinate size, materials, dimensions, etc. via shop drawing submissions.

.2 Pre-Engineered Hatch Cover: Designed by supplier for loads indicated on the drawings. Maximum deflection not to exceed 1/300 of the span or 6 mm.

.3 Hatches to open 90º and lock automatically in that position.

2.10 LOOSE BEARING PLATES AND LEVELING PLATES

.1 Fabricate loose bearing and leveling plates for steel items bearing on masonry concrete construction. Drill plates to receive anchor bolts for grouting.

2.11 STEEL LADDER/RUNGS

.1 Fabricate and install all ladders as detailed on the drawings and reviewed shop drawings and to meet all British Columbia Building Code requirements and to meet all current Occupational Health and Safety Act requirements, including all appendices and to ANSI 14.3.

2.12 FABRICATION

.1 Notify the Owner's Representative and inspection and testing firm a minimum of 24 hours prior to fabrication to allow for inspection.

.2 Fabricate miscellaneous metals in accordance with CAN/CSA-S16.1, the drawings, specifications, and the reviewed shop drawings.

.3 Verify dimensions of existing work, site conditions, and drawing dimensions prior to commencing fabrication.

.4 Welding to conform to the requirements of CSA-W59. Do not splice materials without the written approval of the Owner's Representative. Where granted, provide a complete non-destructive examination by a certified inspection and testing firm; method and firm to be approved by the Owner's Representative. Contractor to pay for all inspection and testing. Show all approved splices on the shop drawings

.5 No cutting or provision for holes except as on approved drawings.

.6 Bolted connections to be friction type connections.

.7 Shop installed shear studs to be installed in strict conformance with requirements of CSA-W59.

.8 Tolerances of all miscellaneous metal to be maintained strictly in accordance with CAN/CSA-S16.1.

.9 Grind all welds smooth and grind all groove welds flush on exposed structural steel.

.10 Do not place any holes or openings in structural steel members without the approval of the Owner's Representative. Where approval is granted, provide reinforcing plates around all openings to maintain design strength.

.11 Weld reinforcement where indicated. Weld in accordance with applicable requirements of CSA-W186. Do not weld reinforcing at any location without written approval of the Owner's Representative.

.12 Weld all anchors required to restrain concrete masonry walls.

.13 Weld shear stud connectors in strict accordance with manufacturer's instructions by electrical resistance only.

.14 Galvanize all structural steel components noted or specified to CAN/CSA-G164.

.15 Apply one coat of paint or primer where required.

.16 Provide two coats of alkali resistant bituminous paint to all aluminium in contact with or embedded in concrete mortar or grout.

2.13 SURFACE PREPARATION

.1 Thoroughly clean and suitably pretreat steel prior to finishing.

.2 Remove loose mill scale, rust, oil, grease, dirt, and other foreign matter using SSPC-SP No. 6, Commercial Blast Cleaning, followed by SSPC – SP No. 1, solvent cleaning. Shop prime all commercial blast cleaned surfaces immediately after cleaning operations.

.3 Grind and sand all sharp projections smooth.

2.14 FINISHES

.1 Shop paint items, all miscellaneous metal items except for those which are to be galvanized or special coating.

.2 Do prime painting to CSA-S16-01. Ensure shop primers are compatible with paint finishes and special coatings.

.3 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale of grease. Do not paint when temperature is lower than 7°C.

.4 After fabrication, clean, remove rust, mill scale, grease, or extraneous material. Unless specified otherwise, apply to all items, in shop, a full smooth coat of primer (see materials). Work paint into corners and open spaces.

.5 Apply two (2) coats of primer to parts inaccessible after assembly.

.6 Apply one (1) coat of primer to steel surfaces except where encased in concrete. Leave these surfaces clean and uncoated.

.7 Touch-up burnt or scratched surfaces. Touch-up bare or worn areas on site after installation, and apply field painting also to field-installed bolts, welds, screws, etc.

.8 Make good corrosive protection after welding where burnt by welding operations and where removed to facilitate welding operations, using two (2) coats of zinc-rich touch-up primer conforming to CAN/CGSB-1.181.

.9 Back prime with bituminous paint all aluminum surfaces in contact with concrete or masonry.

.10 Provide hot dipped galvanized finish at all exterior metal fabrications and elsewhere indicated.

Part 3 Execution

3.1 SURFACE CONDITIONS

.1 Prior to installation of the Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

.2 Verify that metal may be fabricated and erected in strict accordance with the original design, the approved shop drawings, and the referenced standards.

.3 In the event of a discrepancy, immediately notify the Owner's Representative.

.4 Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 ERECTION

.1 Erect in accordance with approved drawings. Erect true and plumb. Use temporary bracing where necessary to take care of all loads to which the structure may be subject, including erection equipment and operation of same. Leave such bracing in place if required for safety.

.2 Use bolts for field connections except where welded field connections called for on drawings.

.3 Tolerance of all structural steel to be maintained strictly in accordance with CAN/CSA-S16.1.

.4 Obtain acceptance of Owner's Representative prior to site cutting or adjusting other work.

3.3 CERTIFICATION

.1 Certify at the completion of work, under the seal and signature of the Contractor's professional Engineer responsible for this work, that all connections and components designed by the Contractor are capable of supporting the loads and forces indicated in the contract specifications and on the contract drawings and that all connections and components are fabricated and installed in accordance with the reviewed Shop Drawings.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 The General Conditions, Supplements and Amendments shall govern the plumbing sections (ie. 22 00 00 to 22 99 99 sections) of the work (read in conjunction with the Instructions to Tenderers or Bidders). This section covers items common to the 22 00 00 series sections and is intended only to supplement the requirements of Division 1.

.3 Plumbing drawings are diagrammatic and approximately to scale. They establish the scope of the plumbing work and the general location and orientation of the plumbing facilities. Plumbing facilities shall be installed generally in the locations and generally along the routings shown close to the building structure with minimum interference with other services. Piping shall be concealed within walls, ceilings or other spaces and shall be routed to maximize head room and the intended use of the space through which they pass, unless specifically noted otherwise.

1.2 OCCUPANCY DOCUMENTATION

.1 The contractor shall submit the following documentation to the Consultant a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the project architect, project manager or Certified Professional. It is the contractor’s responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.

.2 Include the services of a Supporting Professional Engineer to design and certify the seismic restraints for all plumbing piping systems in accordance with the Province of BC Building Code. Provide signed and sealed Letters of Assurance Schedule S-B and Schedule S-C for the project.

.3 Backflow Prevention Assembly Test Reports for each backflow prevention device, signed by the tester:

.4 Letter confirming that all penetrations of rated assemblies have been fire stopped in conformance with CAN4-S115, on the firestopping installing agencies letterhead.

.5 Copies of pressure test reports for all piping systems on contractor’s letterhead.

.6 Chlorination certificates for potable water systems.

.7 Balancing reports for domestic hot water recirculation systems.

.8 Plumbing inspector's final certificate.

.9 Maintenance manuals for plumbing systems.

1.3 TEMPORARY USAGE OF PLUMBING EQUIPMENT

.1 Plumbing equipment and systems shall not be used without the written permission of the Design Authority and in no circumstances shall be used prior to testing and inspection.

1.4 CHROMIUM PLATED PIPING

.1 Use strap wrenches only on chromium plated pipe or fittings. Surfaces damaged by wrench marks shall be replaced. Joints shall be threaded or slip joints.

1.5 SEISMIC PROTECTION

.1 Refer to Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

Part 2 Products

2.1 PRODUCT CONSISTENCY

.1 All products utilized on the project shall be as per the shop drawing submissions.

.2 All products of a similar nature, used in a similar system or application shall be of the same manufacturer throughout the project.

2.2 ACCESS DOORS

.1 Design:

.1 Plaster or wet wall construction: 1.70 mm [14 gauge] thick bonderized steel flush with wall or ceiling type with concealed flange. - Acceptable Product: Acudor PS-5030.

.2 Masonry or drywall construction: 1.35 mm [16 gauge] thick for 400 mm [16"] x 400 mm [16"] and smaller, 1.70 mm [14 gauge] thick for 450 mm [18"] x 450 mm [18"] and larger bonderized steel face of wall type with exposed flange. - Acceptable Product: Acudor UF-5000.

.3 Water resistant finished walls, tile, ceramic tile, water resistant dry wall, plaster or wet wall construction in washrooms and other special areas: 1.80 mm [14 gauge] thick stainless steel flush with wall or ceiling type with concealed flange. - Acceptable Product: Acudor PS-5030 stainless.

.4 Acoustical tile ceiling and similar block materials: 1.70 mm [14 gauge] thick bonderized steel recessed ceiling type. - Acceptable Product: Acudor AP-5010 or AT-5020.

.5 Feature wall construction: Recessed wall type that is selected to complement and conform with the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.

.2 Minimum Requirements:

.1 Materials:

.1 Concealed hinges.

.2 Adjustable anchoring straps or lugs to suit construction.

.2 Finish:

.1 Prime coat bonderized steel types.

.2 Brushed stainless steel for stainless steel types.

.3 Size:

.1 200 mm x 200 mm [8" x 8"] for cleanout access.

.2 300 mm x 300 mm [12" x 12"] for hand access.

.3 600 mm x 600 mm [24” x 24”] for entry access Comment: UBC Hospital requirement

.4 Locking devices:

.1 Flush key operated cylinder lock.

.5 Additional requirements:

.6 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label. (ie. Acudor Fire Rated FW-5050 or FB-5060).

.7 Submit shop drawings.

.8 Supply and locate all access doors under this section of work. Installation shall be by the Prime Contractor.

.9 Acceptable Products: Acudor, Can-Aqua, Mifab, Milcor, Nystrom, Van-Met

2.3 CLEANOUTS

.1 Cleanouts shall be full size for pipe sizes up to 100 mm [4"] and not less than 100 mm [4"] on larger sizes. Cleanouts in inside finished areas shall all be of the same shape either round or square.

.2 Cleanouts passing through a waterproofed floor or a slab on grade subject to hydrostatic pressure shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing. Refer to Section 15401, 'Safes, Flashings and Vent Terminals'.

.3 Pipe manufacturers' cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.

.4 Make cleanouts with Barrett type fitting that has a bolted cover plate and gasket, fitting that has a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.

.5 Outside area cleanouts shall be of heavy duty construction. - Acceptable Product: Zurn Z1400, Jay R. Smith 4220, Watts, Mifab

.6 Unfinished concrete area cleanouts shall be of heavy duty construction and have a fully exposed scoriated cover. - Acceptable Product: Zurn Z1400, Jay R. Smith 4229, Watts, Mifab

2.4 PIPE SLEEVES AND ESCUTCHEONS

.1 Non-combustible pipe penetrations through fire separations that are required to have a fire resistance rating shall be as follows:

.1 Interior concrete or block wall sleeves shall be steel pipe or removable plastic pipe.

.2 All penetrations shall be fire stopped to a CAN4 S-115 listed assembly.

.2 Pipe penetrations through separations that are not required to have a fire resistance rating shall be as follows:

.1 Interior concrete or block wall sleeves and floor slab sleeves in dry areas shall be steel pipe or removable plastic pipe.

.2 Floor slab sleeves in wet areas, outside wall sleeves and roof slab sleeves shall be steel pipe.

.3 Submit shop drawings(s) of listed assemblies for each type of penetration through a rated assembly.

2.5 MISCELLANEOUS METAL RELATED TO PLUMBING SYSTEMS

.1 Frames shall be of welded construction consisting of angle iron sections with 7.9 mm [5/16"] locating strips and anchoring lugs at a minimum of 900 mm [36"] centres.

.2 Cover plates shall be constructed of minimum 7.9 mm [5/16"] checker plate in sections not exceeding 0.93 square metres [10 ft^2] in size with lifting holes at each end of each section. Cover plates shall be provided complete with at least two lifting keys.

.3 Gasketing between frames and cover plates on sanitary systems shall be of rubber construction.

.4 Backing Plates shall be adequate to support the use intended and shall be a minimum 4.76 mm [3/16"] in thickness.

2.6 PIPE BEDDING

.1 All buried piping inside the building below floors and slabs except for footing drains, shall be supported on a bed of well compacted sand (ie. 95% Modified Proctor Density). Bedding shall extend from 150 mm [6"] below pipe and shall support the pipe barrel; not the joints and/or couplings. Before backfilling, the complete line shall be inspected and approved by the Authorities Having Jurisdiction.

Part 3 Execution

3.1 PIPING INSTALLATION

.1 General:

.1 Install piping straight, parallel and close to walls and ceilings, with a fall of not less than 1:100 for gravity piping and with a slope to drain cocks, fixtures or equipment for all pressure piping unless otherwise indicated on drawings. Use standard fittings for direction changes. Provide drain cocks as required.

.2 Install groups of piping parallel to each other; spaced to permit application of insulation, identification, and service access, on trapeze hangers.

.3 Where pipe size differs from connection size to equipment, install reducing fitting close to equipment. Reducing bushings are not permitted.

.4 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.

.5 Ream ends of pipe and tubes before installation.

.6 Lay copper pipe so that it is not in contact with dissimilar metal and will not be crimped or collapsed. All joints on cast or ductile iron pressure service piping shall be made electrically conductive.

.7 Install flanges or unions to permit removal of equipment without disturbing piping systems.

.8 Clean ends of pipes or tubing and recesses of fittings to be jointed. Assemble joints without binding.

.9 Install piping to connections at fixtures, equipment, outlets and all other appurtenances requiring service. Trap and vent waste connections to fixtures. Grade all vents to drain back to waste piping.

.10 Plug or cap pipe and fittings to keep out debris during construction.

.11 Jointing of pipe shall be compatible with type of pipe used.

.12 Non-corrosive lubricant or Teflon tape shall be applied to the male thread of threaded joints.

.13 Flush and clean out piping systems after testing.

.2 Equipment Drainage:

.1 Install drain valves at low points.

.2 Extend equipment drain piping to discharge into floor or hub drain.

.3 Expansion and Contraction and Building Seismic Joints:

.1 Support piping to prevent any stress or strain.

.2 Install pressure piping with loops and offsets which will permit expansion and contraction to occur without damaging the pressure piping system.

.4 Buried Piping:

.1 Lay pipe on compacted bedding of clean, coarse sand free from clay, snow or ice, organic matter or stones.

.2 Do not lay pipe in water or when conditions are unsuitable.

3.2 ACCESS DOORS

.1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, special equipment, trap primers, vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, maintenance and replacement.

.3 Do not locate access doors in feature walls or ceilings without the prior approval of the Consultant. Locate in service areas and storage rooms wherever possible.

3.3 CLEANOUTS

.1 Install cleanouts at the following locations:

.1 Building drain leaving building on the upstream side of exterior wall.

.2 Changes of direction of more than 45 degrees in drainage piping.

.3 Nominally horizontal branch or building drain at intervals of not more than 7.5 metres [25'] for pipe sizes 65 mm [2½"] and less, 15 metres [50'] for 75 mm [3"] and 100 mm [4"] pipe sizes, and 26 metres [85'] for pipe sizes larger than 100 mm [4"].

.4 Fixture drain of a sink, kitchen piping or grease waste piping at intervals not exceeding 7.5 metres [25'] for pipe all sizes.

.5 Base of soil or waste stacks and rainwater leaders.

.6 As called for by the B.C. Building Code.

.2 Cleanouts which are located low on walls shall be located 75 mm [3"] minimum above the top of the baseboard or minimum 200 mm [8"] above finished floor level where there is no baseboard.

.3 Cleanouts shall be coordinated with all millwork and with all other obstructions, shall be placed in readily accessible locations and shall have sufficient clearance for rodding and cleaning.

.4 Extend cleanouts to the finished floor or wall unless exposed in a basement room, pipe tunnel or accessible crawlspace.

.5 Cleanouts in wet floor areas shall extend above the floor in walls or be provided with gasketted waterproofed tops.

.6 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

.7 Cleanouts serving fixtures in Healthcare Facilities, Mortuaries, Laboratories and similar occupancies, where contamination by bodily fluids is likely, shall be located a minimum of 150mm [6”] above the flood level rim of the fixture.

3.4 HANGERS AND SUPPORTS

.1 Refer to section 22 05 29 for Hangers and Supports for Plumbing Piping & Equipment.

3.5 PIPE SLEEVES AND ESCUTCHEONS

.1 Supply and installation of pipe sleeves is included in this section of the work. Install chrome plated escutcheon plates on exposed piping passing through walls, floors and ceilings in finished areas. Sleeves shall be concentric with pipe and; except at fire separations, shall be sized to allow for the continuity of insulation.

.2 Extend sleeves 50 mm [2"] above floor slabs in wet areas. Wet areas include equipment rooms, janitor's rooms, kitchen areas, utility rooms, bath areas and washrooms.

.3 Extend sleeves through outside walls to 25 mm [1"] beyond the exterior face and caulk with flexible caulking compound.

.4 Where removable plastic sleeves are used they shall be removed prior to pipe penetration and the resulting hole shall be then classified as the sleeve.

.5 Extra high vertical risers for cold water and hot water systems with many horizontal branch takeoffs passing through sleeves set in rigid structure adjacent to the main risers, sleeves shall be set to accommodate long term structural movement to avoid imposing stress on these systems.

3.6 CORE DRILLING AND CUTTING

.1 Arrange and pay for the cost of all core drilling and cutting for plumbing systems in this section of the work.

.2 Verify the location of existing service runs and structural reinforcement within existing concrete floors and walls prior to core drilling and cutting. Coring and cutting of structural building components shall only take place upon the receipt of specific written approval of the structural engineer.

.3 X-ray all concrete walls, partitions, shafts, slabs and other concrete or concrete block assemblies prior to coring. The cost of x-raying shall be included in the cost of the Work. Repairs to existing services damaged as a result of core drilling is included in this section of the Work.

.4 Penetrations up to 150 mm [6"] nominal pipe size in precast concrete may be cored on site by the plumbing trade. Larger penetrations shall be located and arranged for in precast work with the precast manufacturer prior to shipping to the construction site.

3.7 MISCELLANEOUS METALS RELATING TO PLUMBING SYSTEMS

.1 All miscellaneous metal related to the plumbing systems including, all mild steel checker plate sump covers and frames, all metal back up plates and supports for all ceiling or wall supported equipment or plumbing fixtures, all steel covers or cages to protect exposed piping subject to mechanical damage is part of this section of the work.

.2 Lay out the location of all pipe trenches and sumps and coordinate the construction thereof with the responsible contractor.

.3 Frames and cover plates which are out of level or warped are unacceptable.

.4 Prime coat after fabrication with two coats of red primer.

.5 See separate division of specification for finish painting requirements.

3.8 PIPING EXPANSION

.1 All piping systems, including all take-offs shall be so installed within the building that the piping and connected equipment will not be distorted by expansion, contraction or settling.

.2 If circumstances on the job require additional changes in direction from those shown on the drawings, the configuration shall be adjusted to suit at no extra cost.

.3 Anchors shall be installed where necessary to control expansion. Expansion joints or loops shall be installed on hot water piping where required.

3.9 TESTING AND INSPECTION

.1 Provide at one hundred and twenty (120) business hours' notice in advance of making the required tests.

.2 All leaks shall be corrected by remaking the joints. The systems shall be retested until no leaks are observed.

.3 No plumbing system or part thereof shall be covered until it has been inspected and approved by the Plumbing Inspector.

.4 If any plumbing system or part thereof is covered before being inspected or approved, it shall be uncovered upon the direction of the Plumbing Inspector or Consultant.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment, and Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Comply with all requirements of that Section of work as related to general requirements, products, and execution.

.2 Provide hangers and supports on all plumbing piping and equipment including:

- .1 Domestic cold water.
- .2 Domestic hot water.
- .3 Sanitary waste.
- .4 Tanks

.3 Hangers, threaded rods, nuts, and associated components for hanging of underslab piping shall be stainless steel and shall be fixed to the foundation or structural slab.

.4 Spacing of hangers shall comply with B.C. Building Code.

1.3 SEISMIC RESTRAINTS

.1 Supply and install seismic restraints for all plumbing piping systems in accordance with the Province of BC Building Code and suitable for post disaster construction (importance value 1.5).

.2 Include the services of a Supporting Professional Engineer to design and certify the seismic restraints for all plumbing piping systems in accordance with the Province of BC Building Code. Provide signed and sealed Letters of Assurance Schedule S-B and Schedule S-C for the project.

.3 Power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the plumbing systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 Provide vibration isolation on all plumbing piping and equipment.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Comply with all requirements of that Section of work as related to general requirements, products, and execution.

.2 Provide seismic restraints on all plumbing piping and equipment including the following:

.1 Domestic cold water.

.2 Domestic hot water.

.3 Sanitary waste.

.4 Tanks.

1.3 SEISMIC RESTRAINTS

.1 Supply and install seismic restraints for all plumbing piping systems in accordance with the Province of BC Building Code as required for post disaster construction (importance value of 1.5).

.2 Include the services of a Supporting Professional Engineer to design and certify the seismic restraints for all plumbing piping systems in accordance with the Province of BC Building Code. Provide signed and sealed Letters of Assurance Schedule S-B and Schedule S-C for the project.

.3 Power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the plumbing systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 Provide identification on all plumbing piping, valves and equipment including the following:

- .1 Domestic cold water.
- .2 Domestic hot water.
- .3 Sanitary waste.
- .4 Polymer
- .5 Sludge
- .6 Tanks

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the contract documents and design intent. It is the activation of the completed installation.

.2 Comply with all requirements of that Section of work as related to general requirements, products and execution.

.3 Provide commissioning of all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water.
- .3 Sanitary waste.
- .4 Tanks and all other equipment.

.4 Commissioning related to plumbing systems shall include the start-up, set up, adjustment and recording of the operational data of at least all of the following systems and components as related to the project:

- .1 Incoming municipal water pressure.
- .2 Domestic water heater temperature set points.
- .3 Central and individual tempered water mixing valve set points.
- .4 Operation of all plumbing fixtures including adjustments of all flush valves.
- .5 Set points for all control devices.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Domestic water system includes domestic cold water and domestic hot water.

.2 Interior domestic water piping shall be provided as depicted on the drawings to all plumbing fixtures, appliances and equipment that require domestic water service.

.3 New interior domestic water piping shall be connected to receive domestic water supply from the existing domestic water piping as depicted on the drawings.

.4 Mechanical makeup water piping systems shall be constructed of materials, installed and tested as specified in this section of the work.

.5 Electric Hot Water Tank Heater (to support eyewash station per local codes).

Part 2 Products

2.1 PIPE AND FITTINGS

.1 Cold water:

.1 Water pipe and fittings inside the building:

.1 Polyvinyl chloride (PVC) Schedule 40 pressure pipe to CSA B137.3 with solvent welded socket fittings to ASTM D2466/D2467.

.2 Hot water:

.1 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42. All copper water tubing shall be certified by the Canadian Standards Association or Warnock Hersey Professional Services Ltd. to ASTM B88.

.3 Above ground copper water pipe fittings inside the building:

.1 Use of the 'T-Drill' system of joining copper piping is unacceptable.

.2 Cast brass or wrought copper solder joint pressure fittings to ASME B16.22 minimum, with 95/5 Sn/Sb or Silvabrite 100 solder

.3 Cast bronze or wrought copper roll grooved pressure fittings with grooved mechanical pipe connector couplings with angle bolt pad and Victaulic style of 'flush seal' gaskets or Shurjoint ‘Gap Seal’ gaskets.

.4 Acceptable Products:

.1 Victaulic 'The Copper Connection System for Copper Tubing (CTS)' with 606 couplings, 600 Series fittings and 641 flange adaptors.

.2 Shurjoint copper series for copper tube sizes CTS, cast bronze fittings, C305 rigid couplings, C306 reducing couplings, C341 flange adaptors and C307 transition couplings.

.5 Exception: Where compression fittings are required they shall be to ANSI B16.22.

.4 Welding

.1 P.V.C. hot air welding in strict accordance with manufacturers recommendations shall be allowed only for non-leak flanges or back welding of glued fittings, or by permission of the Engineer.

.2 Obtain manufacturers procedure literature before welding of pipe. Submit this literature to engineer as part of shop drawings. Have the procedures on site during installation of all piping.

.3 When welding is permitted the contractor shall demonstrate to the engineer his ability to properly weld P.V.C. piping prior to welding finished products.

.5 Quality Assurance

.1 All piping, fittings and valves shall be to the latest standards and as follows:

.2 PVC - CSA B 137.3-M

.6 Gaskets

.1 Gaskets and sealer shall be specifically labelled for use with piping

2.2 VALVES

.1 Ball Valves:

.1 Water to 100 mm - All PVC ball valves are to be "Safe-Bloc" (or equal) with EPDM seals and cushioned Teflon ball seats.

.1 Carriers for Teflon seats will be screw-in type internally adjustable from both ends.

.2 PVC compound will be Type I, Grade 1, cell classification 12454-A, with minimum suffix "A" designation for chemical resistance as per ASTM D-1784.

.3 PVC compound and EPDM seals shall meet CSA Standard B-137.0 Para 5.2.1 environmental requirements for toxicity.

.4 Schedule 80 socket ends will conform to ASTM D-2467.

.5 Schedule 80 threaded ends will conform to ASTM D-2464.

2.3 DOMESTIC WATER HEATER – PACKAGED TANK TYPE

.1 Glass-lined, electric hot water heater and tank, ASME construction, CSA listed, rated for 1034 kPa [150 psig] working pressure.

.2 Plated copper elements, fully automatic controls, manually adjustable thermostat, 120 volt control circuit powered by a fused transformer.

.3 Extra density, vermin proof, glass fibre insulation with heavy gauge steel jacket finished with baked enamel finish over bonderized under coat.

.4 Magnesium anode protection, heavy duty magnetic contactors, fuse protection against excessive current flows.

.5 Equipment Schedule:

.1 Recovery of 93 lph [25 USgph] at a 56°C temperature rise.

.2 Storage capacity: Minimum of 286 liters

.3 Input rating: 6 kilowatts

.6 Standard of Acceptance: A.O. Smith Model DRE-80

2.4 MIXING VALVE FOR HOT WATER SYSTEM

.1 Thermostatic mixing valve shall be specifically designed for thermostatic water mixing for emergency shower/eyewash applications meeting ANSI Z358.1. Valve shall have cold water bypass in case of hot water failure, positive shut-off on cold water failure, capacity to 113 litre/minute at -138 kPa pressure drop, dial thermometer from 0 to 50C (minimum) on tempered water supply to emergency shower/eyewash, locking temperature regulator and union angle check stops on inlets.

.2 Acceptable Products: Guardian Equipment, Bradley, Lawler, Speakman

Part 3 Execution

3.1 GENERAL

.1 Install in level and secure to wall in accordance with manufacturer's recommendations, the authority having jurisdiction and to the requirements of CSA B149.1.

.2 Slope vent to termination.

.3 Adjust burner to manufacturers requirements and CSA B149.1. Provide written report of set up.**PIPE INSTALLATION**

.1 Schedule 40 P.V.C. shall not be threaded on site. Drill and tapping are not allowed. Use saddles for large differential connections.

.2 Solvent Cement

.1 All cementing shall be done at temperatures exceeding 5°C.

.2 Piping must be cut square and all burrs removed from inside and outside of cut end of pipe.

.3 All piping shall be cleaned prior to cementing.

.4 Follow manufacturers published literature for priming and gluing of pipe ensuring the use of correct size of brush and that fittings are twisted 90° prior to glue setting.

.5 For pipes over 300 mm, joints shall be clamped for specified curing time.

.3 Pipe Supports For P.V.C Piping

.1 Hangers to be epoxy coated for humid environments.

.2

Maximum Spacing (mm) Pipe Size	25 mm	30 mm	40 mm	50 mm	65 mm	75 mm	100 mm	150 mm	200 mm
Temp Range									
Up to 80 F	1.2 m	1.5 m	1.5 m	1.5 m	1.8 m	1.8 m	2.1 m	2.4 m	2.7 m
Between 80 - 100 F	1.2 m	1.2 m	1.2 m	1.2 m	1.5 m	1.8 m	1.8 m	2.1 m	2.4 m
Over 100F	0.9 m	0.9 m	1.2 m	1.2 m	1.2 m	1.5 m	1.5 m	1.8 m	2.1 m
Hanger Rod Diameter	10mm	10mm	10mm	10mm	10mm	12mm	16mm	18mm	25mm

.3 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent pipe.

.4 Place a hanger within 300 mm of each horizontal elbow, tee, joint, etc.

.5 Dielectrically isolate dissimilar metals.

.6 Provide injection molded fittings wherever possible.

3.3 FLANGES AND UNIONS

.1 Provide on all connections to reducing valves, control valves, fixtures, and equipment.

3.4 TESTING AND INSPECTION

.1 Testing shall consist of hydraulic pressure testing at 1,400 kPa [200 psi] for 8 hours.

.2 Submit signed and dated pressure test reports for all sections of the water distribution systems.

3.5 DOMESTIC WATER HEATERS AND TANKS

.1 Isolate tanks from floor. For vertical tanks with legs, provide pads under feet, and isolation washers and sleeves at each anchor bolt.

.2 Provide temperature and pressure relief valves. Install such that probe properly senses the temperature. Pipe relief port full outlet size to drain. Position discharge at drain to prevent splash-over.

.3 Provide valved drain from each tank piped to nearest funnel or hub drain.

.4 Connect to cold water supply lines and domestic hot water distribution piping with 300mm (12 in) long, line size flexible connections.

.5 Instruments with external electric wiring to be isolated from heaters and tanks with dielectric bushings or dielectric unions

.6 Install thermometers at domestic hot water storage tank inlet and outlet.

.7 Provide vacuum relief valve and check valve on cold water supply.

.8 Provide isolating valves at all tank and heater water connections.

.9 Provide a corrosion resistant water tight pan under any hot water storage tank and/or hot water heater/storage tank in compliance with the B.C. Plumbing Code and local by-laws.

.10 Galvanic isolation to be provided on all connections from domestic hot water tank which transition from stainless steel to other metals.

.11 Provide bypass ahead of isolation valves on primary side of plate and frame heat exchangers. Flush system fully with heat exchangers isolated prior to commissioning.

3.6 MIXING VALVE

.1 Mount the mixing valve in a wall mounted stainless steel cabinet, adjacent to the eyewash/shower.

.2 Connect 32 mm cast brass P trap with escutcheon from eyewash drain.

.3 Connect 25 mm hot and cold water to mixing valve complete with upstream shutoff valves and check valves.

.4 Provide a water tight electric brass flow switch in the fixture inlet piping, wired to an integral audible horn/ strobe light, mounted on or above the fixture.

.1 Division 26 shall wire 120/1/60 power to the unit electrical panel.

.5 Acceptable Products: Guardian Equipment, Bradley, Speakman, Haws

3.7 FLUSHING AND CHLORINATION OF WATER LINES

.1 Thoroughly flush all water piping so that it is free from scale, sediment and debris as soon as possible after the system is filled with water.

.2 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C-601.

.3 Retain a reputable firm qualified to supervise and inspect the chlorination and flushing procedures and perform chemical biological tests as required.

.4 The piping shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after standing for 24 hours. Hypochlorite and water is recommended as a disinfectant. AWWA C-601 recommends the amount of chlorine required.

.5 Submit to the Consultant a certificate from the testing firm stating that chlorination and flushing has been successfully completed.

.6 On projects with water piping being connected to the existing water distribution system including system piping modifications, piping extensions, tenant fit outs etc. flushing and chlorination of all new piping remains a requirement. Provide all required isolation, fill and drain valves required to flush and chlorinate the new piping without impacting the existing system piping.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Interior sanitary piping shall be provided for the dewatering equipment, emergency eye wash and shower station and shall be connected to existing sanitary system as depicted on the drawings and specified in the Civil division.

Part 2 Products

2.1 INTERIOR DRAIN AND FITTINGS

.1 Buried pipe and fittings:

.1 Acrylonitrile-Butadiene-Styrene (ABS) Drain Waste Fittings

.1 conforming to CSA CAN 3-B181.1-M85.

.2 Polyvinyl Chloride (PVC) Drain Waste and Pipe Fittings conforming to CSA B181.2.

2.2 FLOOR DRAINS

.1 Floor drains connected to the sanitary system shall include trap primer connections and trap primer devices.

.2 Contractor shall coordinate final floor drain selection with general contractor for compatibility with flooring assemblies

.3 Refer to drawings for detailed specifications

Part 3 Execution

3.1 FLOOR DRAINS

.1 Install floor drains set low to provide proper drainage.

.2 Generally, do not locate floor drains in the center of mechanical rooms. Locate floor drains in close proximity to the equipment and / or devices that will be discharging water to them, such that drain connections from the equipment and / or devices can be piped to the floor drains without creating a tripping hazard.

.3 Do not locate floor drains in front of doors.

3.2 PIPING

.1 Do not install piping with glued joints at temperatures below those recommended by the solvent manufacture.

3.3 TESTING AND INSPECTION

.1 Tests on the sanitary waste shall consist of hydraulic pressure testing of 3000 mm [10’] for 8 hours.

.2 An air test in accordance with the Plumbing Code may be used during freezing conditions.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 CODES AND STANDARDS

.1 All fixtures shall display CSA (Canadian Standards Association) approval where a CSA standard is available and in effect.

.2 Plumbing fixtures shall comply with CAN/CSA B45, 'General Requirements for Plumbing Fixtures',

.3 Combustible plumbing fixtures shall not exceed the limitations of the flame spread rating (FSR) or smoke development classification (SDC) permitted for the building construction in which they are installed.

1.3 QUALITY

.1 Similar plumbing fixtures shall be of one manufacturer.

.2 Plumbing fixture supply brass shall be of one manufacturer unless otherwise specified.

.3 Fixtures shall be free from flaws or blemishes. Surfaces shall be clear, smooth and bright and have dimensional stability.

.4 Plumbing fixtures and trim shall be brand new unless otherwise noted.

.5 All visible or exposed parts, trim, supplies, traps, tubing, nipples escutcheons, check valves on diverter supply lines and valves to sanitary and/or kitchen fixtures shall be chrome plated finish unless otherwise noted.

.6 All fittings shall have heavy duty stems.

Part 2 Products

.1 Floor Drains:

.1 Floor Drain (FD):

.1 Cast iron floor drain with secondary drainage flange and 125 mm diameter nickel bronze strainer. Cast iron non-plated parts shall be coated for rust prevention.

.2 Include trap primer connection.

.3 Acceptable Manufacturers: Zurn, Watts, Jay R. Smith.

.2 Emergency Eyewash/Shower (EEW/SH):

.1 Shower: Free standing emergency drench shower with barrier free stay open shower valve and eye/face wash with stainless steel bowl and 25mm stay open ball valve controlled by a hand operated triangle on a rigid chrome plated pull rod.

.1 Acceptable Products: Guardian Equipment, Bradley, Haws, Speakman

.2 Provide individual mixing valve with check stops for each emergency shower. Thermostatic mixing valve shall be specifically designed for thermostatic water mixing for emergency shower/eyewash applications meeting ANSI Z358.1. Valve shall have cold water bypass in case of hot water failure, positive shut-off on cold water failure, capacity to 113 litre/minute at -138 kPa pressure drop, dial thermometer from 0 to 50C (minimum) on tempered water supply to emergency shower/eyewash, locking temperature regulator and union angle check stops on inlets.

.1 Acceptable Products: Guardian Equipment, Bradley, Lawler, Speakman

.3 Mount the mixing valve in a wall mounted stainless steel cabinet, adjacent to the eyewash/shower.

.4 Connect 32 mm cast brass P trap with escutcheon from eyewash drain.

.5 Connect 25 mm hot and cold water to mixing valve complete with upstream shutoff valves and check valves.

.6 Provide a watertight electric brass flow switch in the fixture inlet piping, wired to an integral audible horn/ strobe light, mounted on or above the fixture.

.1 Division 26 shall wire 120/1/60 power to the unit electrical panel.

.7 Acceptable Products: Guardian Equipment, Bradley, Speakman, Haws

Part 3 Execution

3.1 FIXTURE INSTALLATION

.1 Connect fixtures complete with specified trim, supplies, drains accessory piping, vented traps, stops or valves, reducers, escutcheons and fittings for the proper installation of all fixtures and their respective supply fittings.

.2 Provide necessary hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kilogram [200 pound] mass will not loosen or distort mounting. Provide in-wall concealed carriers as required.

3.2 EMERGENCY EYEWASHES AND SHOWERS

.1 EEW/SH-1:

.1 Provide support for eyewash and mixing valve, where location is away from a supporting wall.

.2 Install flow switch in the inlet fixture piping. Flow switch shall be compatible with flow rate of eyewash.

.3 Install mixing valve cabinet adjacent to emergency fixture.

3.3 FLOORS

.1 Where plumbing fixtures come in contact with floors, joints shall be sealed with Dow Corning anti-mildew 786 building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies the General Provisions for the supply, delivery, installation, calibration and commissioning of the process control and instrumentation system, including all control and graphic panels.

.2 It is the intention of these specifications and drawings, to provide for a complete and fully operating control and instrumentation system, with facilities and services to meet the requirements described herein, and in complete accord with applicable codes and ordinances. The specifications do not purport to cover details entering the design of the system which shall be the responsibility of the Contractor.

.3 The work to be done shall include the provision of all labour, materials, tools and equipment as well as the application of a competent knowledge of construction, whether or not directly specified or shown on the plans, required for the installation testing and placing into service the complete control and instrumentation system, except when it is specifically mentioned that certain materials and/or labour are not part of the contract.

.4 These specifications shall apply to and govern all trades doing control and instrumentation work and shall be read in conjunction with and form a part of the general specifications of the project.

.5 The Control and Instrumentation work includes but is not limited to the following:

- .1 Control panels (vendor panels and existing site PLC panel).
- .2 Primary Elements for flow, level, pressure, temperature, etc.
- .3 Control Wiring and conduit.
- .4 Starters and controllers.
- .5 Indicators, annunciators, interfaces, HMIs, and PLCs.
- .6 Installation and commissioning of owner-supplied Centrifuge.
- .7 Installation and commissioning of owner-supplied Conveyors (Three in total).
- .8 Installation and commissioning of Polymer system.

.6 The plant PLC and SCADA programming and commissioning is the responsibility of the Contractor.

.7 Refer to Section 4 of this specification for high level guidance in providing programming services.

1.2 EQUIPMENT MANUFACTURERS

.1 All equipment shall be manufactured by experienced manufacturers who can demonstrate experience for all equipment offered in similar facilities and processes.

.2 Requests for approval of alternative suppliers shall be submitted for approval. Refer to Section 26 05 01 - Common Work Results for Electrical.

.3 Most of the equipment shall be supplied by a single manufacturer, particularly where aesthetics are of concern, such as in panels.

1.3 CODES, PERMITS & FEES

.1 The work shall comply with the requirements of the current edition of the Canadian Electrical Code, Part 1, and the regulations of the Province of British Columbia.

.2 Obtain the required construction permits, arrange for inspections, and supply the Prime Contractor, District and Engineer with approval certificates pertaining thereto including a certificate of final inspection

1.4 REFERENCE STANDARDS

.1 Unless otherwise specified, equipment shall conform to appropriate standards and recommendations of:

.1 The Instrument Society of America, hereinafter referred to as ISA.

.2 The Canadian Standards Association, hereinafter referred to as CSA.

.3 The American Society of Mechanical Engineers, hereinafter referred to as ASME Standards.

.2 All equipment shall be metric - SI Standard.

1.5 OPERATION MANUALS

.1 Submit operation manuals in accordance with Section 26 05 01 - Common Work Results - Electrical.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with 01 33 00 – Submittal Procedures and the specifications.

.2 Shop drawings to indicate (where applicable):

.1 Completed instrument data sheets by Vendors.

.2 Instrument tag number(s).

.3 Available range.

.4 Materials of construction.

.5 Wetted materials.

.6 Accuracy.

.7 Rating of enclosure.

.8 Other details listed on the Instrument Specification Sheet(s).

.3 Shop drawings for control panels shall include all the information described in Section 01 33 00 – Submittal Procedures.

.4 Attach a copy of the Instrument Specification Sheet to each shop drawing for field instruments.

.5 Clearly indicate on the shop drawing which model, features, materials, etc. are being provided, when more than one is shown.

1.7 RECORD DRAWINGS AND OPERATION AND MAINTENANCE MANUALS

.1 Record Drawings in accordance with the requirements of Section 01 32 00 – Project Record Documents.

.2 Mark up engineering drawings with construction details and submit to Engineer two (2) sets of drawings for plan of record.

.3 Operation and Maintenance Manuals in accordance with Section 01 32 00 – Project Record Documents.

1.8 INSTRUMENTATION SUB-CONTRACTORS

.1 The work as specified in this Section to be performed by a qualified control and instrumentation contractor.

Part 2 PRODUCTS

2.1 PROCESS PIPING CONNECTIONS

.1 Connections to be in accordance with instrument details shown on the drawings or attached to the instrument specification sheets and manufacturer recommended installation procedures.

.2 Pipe or tubing fittings and valves for process leads to instruments to be of the type, material and pressure standard as called for on the process piping standard of the line pressure being sensed.

.3 Process leads to be sloped, vented, and sized in accordance with accepted instrument practices in the industry. Provide necessary unions in the pipe or tubing to allow removal of instruments for service.

.4 Piping and capillary tubing lines between instruments and points of connection to be supported and located to be protected from damage and deflection.

2.2 MATERIALS

.1 All materials shall be new and in new condition.

.2 All materials shall bear the approval of the Canadian Standards Association (CSA).

.3 All materials shall be suitable for full operation within specified environments.

2.3 POWER SUPPLIES

.1 Provide all necessary power supplies for controls and instruments.

.2 Power wiring to field devices shall be minimum #12 AWG.

2.4 CONTROL WIRING

.1 Unless specified otherwise, all conductors for control wiring shall be copper with RW90, X-link insulation, 300 Volts. For any control wiring run with power cabling, conductors shall be rated 600 Volts.

.2 Neutral conductors shall be white, grounding conductors shall be green, DC conductors shall be red and AC conductors shall be black.

.3 Instrumentation wiring for analog signals shall be individually shielded - multipair cable #16 AWG (7x16) tinned copper.

.4 Control wiring for level and pressure switches shall be #14 THHN black.

.5 Provide armor for wiring as required when installed near wiring of other systems or other voltages.

.6 Provide shielding for signal and communication wiring.

.7 Where dimensional details are required, work with the applicable structural and architectural drawings.

.8 The Contractor is responsible for correcting any work completed contrary to the intent of the drawings and specification and shall bear all costs for correcting same.

2.5 CONDUIT, WIRING AND CABLE

.1 Supply and install all conduit, wiring, control and instrumentation cables for the control, instrumentation and low voltage and line voltage control for building

services, including those systems not specifically detailed in the drawings. This could include control of HVAC systems, etc.

.2 Conduit and wiring for power, lighting, miscellaneous electrical systems, and power supplies to control instrumentation and building service panels including other components requiring line voltage power supply shall be supplied and installed as specified here and in Division 26.

2.6 JUNCTION BOXES AND ENCLOSURES

.1 All junction boxes and enclosures shall be rated NEMA 4X unless otherwise specified.

.2 All wiring shall be terminated on terminal blocks as specified in Section 26 05 20 – Wire and Box Connectors.

.3 120VAC and 24VDC wiring shall be isolated from each other and terminated on separate terminal strips.

Part 3 Execution

3.1 INSTALLATION

.1 Install and interconnect all process control system equipment.

.2 Install all equipment in accordance with the manufacturer’s recommendations and in a manner that will ensure satisfactory operation upon completion.

.3 Provide all labour and all necessary equipment including timbers, scaffolding, tools, and rigging materials for installation of the equipment.

.4 Contractor shall be responsible for coordinating all mechanical, electrical, and other works for the equipment being installed.

.5 Installation shall meet the minimum standards set forth by Standards and Practices for Instrumentation.

.6 Use trained personnel to install systems and controls as per approved shop drawings and in accordance with manufacturer's recommendations.

.7 Follow building lines with all piping and electrical wiring runs. Utilize proper separation and wiring techniques.

3.2 INSTRUMENT TAGGING

.1 General

.1 Provide each instrument with a tag in accordance with Section 01 18 00 – Identification Systems.

.2 Tags to be stainless steel and supplied by the instrument manufacturer wherever possible.

.3 Affix tags to instruments with nylon tie-wraps or adhesive. Do not use adhesive on curved surfaces.

.2 The Contractor shall tag each instrumentation and control cable conductor with unique identification as given on drawings. The tag at the end of a cable or conductor will identify where the opposite end of the cable or conductor is terminated.

.3 The Contractor shall maintain accurate records during cable, conductor, and conduit installation as to the tags which are to be installed. The Contractor's records shall be turned over to the Engineer for periodic review when requested.

.4 In the event the Contractor must develop a conduit or cable identification not given on drawings the strategy to label all conduit, cable and conductors uniquely by incrementing a numeral behind a C (Control), I (Instrumentation), E (Element) or P (Power) prefix. Where a unique tag number cannot be developed, the Contractor shall advise the Engineer for clarification.

.5 No two wires or cables shall have an identical tag.

3.3 COORDINATION OF WORK

.1 Cooperate and coordinate with other trades on the project.

.2 Check drawings and specifications of other trades for conflict and coordination with the control and instrumentation trade. If any conflicts are found, obtain a ruling from the District and Engineer before proceeding.

3.4 MOUNTING OF INSTRUMENTS, CONTROLS AND ACCESSORIES

.1 Instruments to be installed in accordance with the drawings or as detailed in the installation manual for the equipment. 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 Do not install Instruments until heavy construction work adjacent to the instruments has been completed.

.3 Locate instrument devices including accessories where they will be accessible from structural platforms, permanent ladders, or grade. Mount local indicating instruments facing toward, in line or sight and within reading distance of a normal operating area.

.4 Sufficient clearance to be allowed for removal of equipment such as level displacers and floats, rotameter floats, control valve diaphragms and plugs.

.5 Field located items of instrumentation to be mounted on building columns and walls where such building columns or walls are accessible. Pipe stands and/or other means of support to be provided where the mounting on columns or walls is not practical.

.6 Manifolding for pressure sensing devices to be in accordance with installation detail drawings and as required to provide a functional system that allows maintenance of equipment without shutdown of main process equipment. Manifold details generally show a gauge as the pressure device; however, this will apply to pressure switches, recorders, transmitters, and other pressure instruments.

.7 Where a pressure gauge or other pressure device is supported by a manifold, and conditions of pulsating pressure or mechanical vibration exist, the manifold to be fastened so that no stress is exerted on the pressure connection from a vessel or line.

.8 Pressure gauges which have a safety blowout feature in case of Bourdon tubes to be mounted so that the proper functioning of the blowout is not hindered in any way by mounting plates, insulation, etc.

.9 Instrument housings to be capped, closed, or covered with polyethylene when work is not in progress.

.10 Panels, control stations, and other equipment to be protected against the entrance of dust, dirt, and moisture, and protected against mechanical injury while rough, dirty, wet, or dusty work is in progress. Damage to equipment, including marring of painted surfaces caused by failure to properly protect the equipment, to be promptly repaired by the Contractor to the satisfaction of the Engineer.

3.5 PAINTING

.1 Painted surfaces on material supplied or installed under this contract which are damaged in any way, i.e. by welding, scraping, cutting, etc., to be thoroughly cleaned, primed with a rust inhibiting primer, and repainted to the original colour. The finished job to meet or exceed the original painting specification.

3.6 INSTRUMENTATION WIRING CHECKS

.1 Prior to the installation of the remote I/O, the Contractor shall check each instrument wiring loop between the field instrument and the Control Panel. Verify and check off each wiring loop and correct termination address by initialing each loop on the drawings. Submit verification to Engineer for review. Contractor to supply all necessary power supply and instruments for testing.

.2 Prior to startup, and after all field instruments and the PLC(s) are powered up, complete an Instrument Wiring Check Sheet (see end of Specification) for each PLC module and submit the sheets to the Engineer.

.3 For each signal indicate the Rack, Slot, and Point to which the signal is connected. Indicate whether the signal is an Input to the PLC from a field device or an Output from the PLC to a field device, and briefly detail the signal (e.g. Discharge Valve FCV-604, Full Open Status ZSO-604, 1=Open).

.4 Test discrete input signals by jumpering the field instrument's output contact and noting whether the appropriate indicator light on the PLC input module operates.

.5 Test discrete output signals by jumpering the PLC output at the module's terminals and noting the action of the field device (e.g. valve opens).

.6 Test analog input signals by noting the reading on the field device and measuring the mA signal into the PLC. Check that the mA reading is appropriate for the process variable and the span of the instrument.

3.7 WELDING

.1 Fabricate and install all brackets, hangers, etc., necessary to complete this contract. All welding and welding materials to conform to the requirements of the Owner, Engineer, and local authorities.

3.8 CALIBRATION

.1 Prior to start-up, submit to Engineer calibration sheets for each instrument which is adjustable, indicating the setpoint(s), and by whom the calibration was performed.

.2 For microprocessor-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.

.4 Contractor is to supply all test equipment to calibrate and test equipment and devices.

3.9 TESTING

.1 Thoroughly test all control equipment, components, and systems for proper operation and report in writing to the satisfaction of the Contract Administrator.

.2 Tests shall include:

.1 Complete operational test including interlocks, functions, features, options, etc., for all instrumentation, PLC, and computer system control operations.

.2 Operation of alarm initiating devices.

.3 Calibration of all instruments.

.3 Supply all necessary test equipment and personnel to completely test the entire instrumentation and process control system.

3.10 START-UP AND COMMISSIONING

.1 Perform all panel start-up and commissioning in accordance with Section 26 05 01.

.2 Upon completion of the installation, the Contractor shall be responsible for testing to determine correct system operation and sequences as intended in the Contract Documents. Process Instruments such as flow, level, pressure transmitters, etc., shall be checked for operation prior to process start-up, by manipulating operating controls like set points, auto-manual selectors, etc. Status and alarm contacts to be checked by manipulation or jumpering at the sensing element.

.3 Results of tests are to be logged by the Contractor and submitted to the District and Engineer. Any apparent defects shall be reported and corrected.

.4 When preliminary checks have been completed and process equipment is operating or ready to operate, individual systems shall be calibrated in accordance with the latest ISA recommendation. After calibrations, the system shall be placed in operation in conjunction with the Contractor, District, Engineer, and designated operating personnel.

INSTRUMENTATION WIRING CHECK SHEET

PLC DISCRETE INPUTS AND OUTPUTS

In/Out	Rack	Slot	Channel	Description	Signal Action	Check

Client: _____ Project: _____

Date of Test: _____ Test conducted by: _____

Signature: _____ (Signed): _____

INSTRUMENTATION WIRING CHECK SHEET

PLC ANALOG INPUTS AND OUTPUTS

In/Out	Rack	Slot	Channel	Description	Instrument Reading	mA Signal

Client: _____ Project: _____

Date of Test: _____ Test conducted by: _____

Signature: _____ (Signed): _____

Part 4 Process Philosophy

4.1 GENERAL

.1 All equipment will operate automatically and shut down automatically in the event of a downstream system fault.

.2 All control of the main elements of the system will be available at the facility SCADA.

.3 Vendor supply packages will be integrated into the facility control system and control network as able.

4.2 CENTRIFUGE

.1 The centrifuge will be called to operate in the morning by operations staff. This equipment will automatically call to run the sludge feed pumps, polymer injection (as programmed) and the downstream conveyors as required.

.2 The programming of the centrifuge is completed by others.

.3 The signals available from the centrifuge control panel will be displayed on the site SCADA terminal, including alarms, and run status.

.4 The Operator will call to stop the equipment manually or have a set operating timer to have the system automatically stop at the end of the day. Anticipated 14 hours of operation per day maximum.

.5 Operations will use the new centrifuge 90+ percent of the time but could operate the existing centrifuge in the same manner if required, through the control system.

4.3 SLUDGE FEED PUMPS

.1 The sludge feed pumps are an existing system, being upgraded with 10Hp VFD driven pumps. A flow meter (existing) will allow the system to pace to a set feed rate automatically, with that setpoint provided by the operator and entered in the SCADA interface.

.2 The pumps will be called to operate by way of the centrifuge run command.

.3 The pumps may be operated locally (at the VFD), Remotely in Manual at the SCADA, or Remotely in Auto through the SCADA (and PLC call to run).

.4 The VFDs will provide speed feedback, run status feedback, and fault status feedback, reported on the graphic terminal.

.5 A fault of the feed pumps will stop all centrifuge processing.

4.4 POLYMER SYSTEM

.1 The polymer system is a package which will be operated via a remote command to operate through the site PLC (hard wired). The system will report back a fault status and a run status. The injection setpoint can be set via the SCADA or at the vendor control panel.

.2 The system will be called to operate automatically by way of the centrifuge, and only if enabled to operate automatically by way of a radial button in the SCADA indicating polymer to be added (set by the operator).

.3 The system may be operated in manual remotely through the SCADA terminal.

.4 The system may be operated locally at the vendor control skid.

.5 A fault of the polymer skid, if selected to operate with the centrifuge, will stop all centrifuge processing.

4.5 CONVEYOR SYSTEM

.1 The conveyor system includes three conveyors:

.1 Conveyor 1 transports cake from the original centrifuge to the hopper of Conveyor 3, and operates automatically when the centrifuge is running, and for 3 minutes after the centrifuge stops.

.2 Conveyor 2 transports cake from the new centrifuge to the hopper of conveyor 3, and operates automatically when the centrifuge is running, and for 3 minutes after the centrifuge stops.

.3 Conveyor 3 transports cake from the building (and either Conveyor 1 or 2) to the outside cake bin. The conveyor operates automatically if either Conveyor 1 or 2 is running. Conveyor 3 will continue to operate 3 minutes after Conveyor 1 and 2 are off.

.2 The Conveyor system is a package system that is provide by a Vendor and will be integrated into the site PLC as required. The intent is for the system to have Ethernet/IP communications for control and status monitoring.

.3 The conveyors will be operated with FVR starters, allowing any blockages to be automatically addressed by monitoring rotation failures. The system will allow three attempts to clear a blockage by reversing out of a failure to maintain rotation or a high amp pickup. After three successive failures the system will latch out and require an operator reset. All alarms, timers to detect and reverse, will be located via the site SCADA terminal.

.4 The Conveyors will cause all systems to shut down in the event of a fault.

Operate all equipment in accordance with the manufacturer's recommendations

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 CAN/CSA 22.1-2015, Canadian Electrical Code.

.2 C22.2 No.14-95, Industrial Control Equipment.

.3 C22.2 No.40-M1989 (R1994), Conduit, Junction and Pull Boxes.

.4 C22.2 No.94-M91 (R1997), Special Purpose Enclosures.

.5 NEMA 1-10-1979, Indoor enclosures, outdoor enclosures, ventilated enclosures, knock out and oil resistant gaskets.

1.2 SCOPE OF WORK

.1 It is not the intent of this specification to completely specify all details of control panel design and construction.

.2 The selection of all accessories, materials and methods of fabrication not specifically covered by these specifications, but which are necessary to complete the fabrication of the panels, shall be the responsibility of the Fabricator and shall be carried out in accordance with good engineering practices.

.3 In case of conflict within this specification or between the specification, drawings, purchase order, the accompanying data sheets and any other supplemental specifications, the Contractor shall immediately submit the matter in writing to the Engineer who shall make a determination and written clarification.

.4 Contractor shall have full responsibility for adhering to all local Codes and local inspector's requirements such that there shall be no impact to project schedule.

.5 The scope of work will include fabrication of new panels and additions to existing panels as required. The Contractor will be provided construction drawings for all new panels, including PLC layouts and Card layouts with minimal Loop Drawings. The Contractor shall field verify all back pan and equipment dimensions prior to fabrication.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures. Include:

.1 Bill of Materials showing item reference, tag, quantity, description, manufacturer, model number, and whether the item is shipped loose or installed.

.2 Separate shop drawings for the terminals, DC power supply, relays, control panel breakers, disconnects, motor starters, panel lighting, panel power bars etc.

.3 Loop drawings or schematics showing all internal and field wiring along with terminal numbers, equipment tags, wire tags, settings (for example timer relays) and calibrated ranges (if applicable).

.4 Internal elevation of all back panels and equipment.

.5 External elevation including enclosure rating and dimensions.

.6 List of Lamicoid labels.

.7 Drawings showing wire tags.

.8 Component shop drawings.

.2 Include control panel literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

1.4 CLOSEOUT SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00.

.2 Detailed instructions as required permitting effective operation, maintenance, and repair.

.3 Technical data:

.1 Schematic diagrams of components, controls, and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

Part 2 Products

2.1 GENERAL

.1 Supply the control panels in accordance with the general arrangement and dimensions indicated on the appropriate drawings. Panels must be complete with all instruments, meters, switches, indication lights, relays, etc., as specified herein or as indicated.

.2 Provide removable lamacoid nameplates having letters not smaller than 6 mm to identify equipment.

2.2 OPERATOR CONTROL STATIONS

.1 All enclosures and devices shall be rated NEMA 12 in ordinary environments or NEMA 3R outdoor environments, NEMA 4X in corrosive environments, unless otherwise noted.

.2 A Local Control Panel containing the plant PLC and HMI will be installed in the Electrical Room, and contain equipment detailed in the drawings. This equipment will operate the entire facility and be contained in a steel enclosure suitable for the environment.

2.3 PUSHBUTTONS

.1 Heavy-duty oil tight, operator flush, black, with 1-NO and 1-NC contacts rated at 10 A, 120 VAC, labels as indicated. Stop pushbuttons coloured red

.2 Acceptable manufacturer shall be Telmecanique, Allen-Bradley.

2.4 INDICATING LIGHTS

.1 Heavy duty, push to test LED type

.2 Lens colours: Red for running, Green for off, Amber for alarm

.3 Supply voltage: 120 V (AC)

.4 Labels as specified in Section 26 05 01 – Common Work Results for Electrical

.5 Acceptable manufacturer shall be Telmecanique, Allen-Bradley.

2.5 SELECTOR SWITCHES

.1 2 or 3 position as required, labelled as indicated heavy duty oiltight, operators as indicated, contact arrangement as indicated, rated 120 V (ac), 10 A.

.2 Acceptable manufacturer shall be Telemecanique, Allen-Bradley

2.6 PROGRAMMABLE LOGIC CONTROLLER

.1 The plant programmable logic controller (PLC) is a Logix5000 based controller and will require software to program.

.2 All systems to be programmed for required functionality, including remote start/stop from the main PLC over hardwire (and if decided during shop drawing reviews, Ethernet/IP). PLC programming, Factory Acceptance Testing (FAT), Site Acceptance Testing (SAT) and commissioning is the responsibility of the Contractor.

.3 Acceptable programmers will be integrators local to Vancouver Island with experience with WWTPs and The District work.

2.7 HUMAN MACHINE INTERFACE

.1 A SCADA terminal (iFIX) is required for updates to showcase the additional centrifuge, additional conveyors, replacement polymer system, modification to the sludge pump starters, and modification to the existing centrifuge.

.2 Acceptable programmers will be the PLC programmers selected for the work. Support by the Engineer can be provided for integrators not familiar with the iFIX platform. Graphics shall use 'high performance HMI graphic programming techniques (shades of grey, etc.) where possible, with input from the District.

.3 HMI to be programmed to support local control of primary building process functions, including the following:

.1 Equipment mode (e.g. Hand, Off, Auto, Remote, etc.).
.2 Equipment status (Running, Fault, etc.)
.3 Equipment manual control.
.4 Duty assignments for redundant equipment.
.5 Instrument readings in engineering units.
.6 Process control setpoints and modes.
.7 PID controller setpoint, control variable, and process variable (read-only).
.8 Equipment and plant operating limits, adjacent to real time variables and readings.
.9 Adjustable alarm setpoints.
.10 Overall process screen.
.11 Individual process, equipment, and building system detail screens.
.12 Screen titles.
.13 Screen navigation buttons.
.14 Date and time.
.15 Currently logged-in user.
.16 Mathematical constants page.
.17 Communication heartbeat and status.

2.8 SURGE PROTECTION DEVICE (SPD) – CONTROL POWER

.1 UL1449 2nd Edition rated using metal oxide varisters.

.2 120 V, 15 A, 2 wire grounded input.

.3 MCOV: 150 V.

.4 Surge Current: 45 kA per phase.

.5 3 modes of protection.

.6 Filtering Bandwidth: 10 kHz to 100 MHz.

.7 Noise Attenuation: Normal Mode 75 dB at 100 kHz, Common mode 50 dB at 5 Mhz.

.8 Let Through voltage: 6 V A3 ringwave, 9.6 V B3 Ringwave, 70 V, B3/C1 impulse.

.9 Manufacturer: Cutler Hammer Aegis or approved equal in accordance with B7.

2.9 GENERAL PURPOSE RELAYS

.1 DIN rail mounted.

.2 Coil voltage as required.

.3 Contacts rated 5A, 120/240 V AC inductive, with two (2) N/O and (2) N/C contacts minimum.

.4 Operating time to be 20 ms maximum or AC coil and 30 ms maximum for DC coil.

.5 Rated for 100 000 operations at 5A, 120/240 VAC.

.6 With socket, built in LED or neon lamp operation indicator and push to test push button.

.7 Manufacturers: Allen-Bradley relays shall be type 700-HAX2Z24-1-4 with 700-HN125 relay base for 24 VDC coil voltages, and type 700-HAX2A1-1-4 with 700-HN125 relay base for 120 VAC coil voltage.

2.10 INTRINSICALLY SAFE RELAYS

.1 DIN rail mounted.

.2 Coil Voltage as required.

.3 Div 1, hazardous area classification required.

.4 250V:5A:500W resistive loads; reactive loads must be suppressed

.5 ‘No-Fail’ earth fault protection

.6 LED indicator: on when relay energized.

.7 Manufacturers: MTL model MTL2211 switch operated relay or similar.

2.11 DC POWER SUPPLY

.1 DIN rail mounted.

.2 Switched mode type.

.3 Input voltage 85-230 VAC.

.4 Output voltage 24 VDC output adjustable to + 10%.

.5 Power output as required with 25% spare capacity.

.6 Built-in overload protection.

.7 0.5% voltage regulation Minimum-Maximum input voltage.

.8 1.0% voltage regulation 10% to 100% load.

2.12 ETHERNET PATCH CABINETS, COMMUNICATIONS AND SWITCHES.

.1 Contractor is responsible for all Ethernet / communications cabling and terminations. Contractor to provide all wall plates, patch panels and all other required equipment to provide a clean installation.

.2 All Ethernet patch cables are to be of type 6 with properly terminated ends to ANSI/TIA/EIA 568A wiring standards to support gigabit Ethernet.

.3 Termination equipment design based on Panduit

.4 All Armoured Ethernet cable to follow applicable ANSI/TIA/AIA 568A wiring standards.

.5 The main plant PLC cabinet requires a second ethernet switch. The contractor will supply one additional switch, minimum of 8 ethernet ports, and install within the PLC enclosure on the left side-pan beside the existing 708TX switch.

2.13 WIRING

.1 Internal Control Panel Wiring for 120 VAC Power Distribution Circuits

.1 Rated No. 14 AWG, 600V PVC type insulation rated for minus 40 deg. C. to +105 deg. C., CSA rating TR-32, UL Style 1015, tinned, stranded copper conductor, as manufactured by Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.2 Internal Control Panel Wiring for PLC 120 VAC Discrete Signals and for PLC 24 VDC Discrete Signals.

.1 Maximum 8 A circuit protection: Rated No. 16 AWG, 600V PVC type insulation rated for minus 40 deg. C. to +105 deg. C., CSA rating TR-32, UL Style 1015, tinned, stranded copper conductor, as manufactured by Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.2 Maximum 15 A circuit protection: Rated No. 14 AWG, 600V PVC type insulation rated for minus 40 deg. C. to +105 deg. C., CSA rating TR-32,

UL Style 1015, tinned, stranded copper conductor, as manufactured by Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.3 Internal Control Panel Wiring for 24VDC Analog Signals.

.1 Stranded No.18 AWG tinned copper conductors, 300V with individual shielded twisted pairs. Use Belden Type 9318 for cables requiring 1 pair of individually shielded twisted pairs, Belden 9368 for cables requiring 2 pairs of individually shielded twisted pairs, and Belden 9388 for cables requiring 4 pairs of individually shielded twisted pairs.

.2 Manufacturers: Belden, Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.4 All wiring shall be color coded as follows:

.1 Analog signal pairs.

.1 White: DC positive.

.2 Black: Signal common.

.2 Analog signal triads:

.1 Red: DC supply to device.

.2 White: Analog signal from device.

.3 Black: Signal common.

.3 DC POWER WIRES

.1 Blue: DC positive.

.2 Brown: DC negative/common.

.3 Green: Grounding.

.4 AC POWER WIRES

.1 Black: AC supply/hot.

.2 White: AC neutral.

.3 Green: Grounding.

.5 PLC DISCRETE I/O (AC VOLTS)

.1 Red: AC Input

.2 Orange: AC Output

.6 PLC DISCRETE I/O (DC VOLTS)

.1 Violet: DC Input

.2 Grey: DC Output

2.14 GROUNDING

.1 Provided grounding lug, suitable for termination of #2 AWG to #2/0 AWG copper grounding cable.

.2 Separate grounding bars are to be provided for power grounds and instrument control system grounds (signal cable grounding, etc.).

2.15 SPARE PARTS

.1 Provide in accordance with Section 01 78 00 Closeout Submittals, the following spare parts:

.2 30 fuses of each type and rating used.

.3 2 control relays of each type used.

2.16 TERMINAL BLOCKS

.1 Screw connection terminals to be mounted on 35 mm DIN rails.

.1 Fused, 24 V DC shall be CSA approved for 300 V, accepting #12 - #16 AWG wire with blown-fuse indicator lamp. Weidmuller ASK-1 22276-0000 or similar.

.2 Unfused, 24 V DC shall be CSA approved for 300 V, accepting #12 - #16 AWG wire. Terminals shall be Weidmuller SAK 4 feed through type or similar.

.3 Fused, 120 V AC shall be CSA approved for 300 V, accepting #12 - #16 AWG wires, with blown-fuse indicator lamp. Weidmuller ASK-1 22556-0000 or similar.

.4 Unfused, 120 V AC devices shall be CSA approved for 300 V, accepting #12 - #16 AWG wires. Weidmuller SAK 4 feed through type or similar.

.2 Terminals colors shall be as follows:

.1	Ground	GREEN
.2	120V Line	BLACK
.3	120 V Neutral	WHITE
.4	+24 V DC	BLUE
.5	-24 V DC	BROWN

2.17 CONTROLS CIRCUIT PROTECTION

.1 Fuses: size as required, to match terminal blocks.

.2 Internal Control Panel Breakers:

.1 DIN rail mounted.

.2 CSA certified as a branch breaker protecting No.16 wire on load side of breaker.

.3 Size as required, maximum rating to be 80% of load side wire rating.

2.18 WIREWAYS

.1 Plastic wiring raceway with removable covers.

.2 Separate raceways shall be provided as follows:

.1	DC (24 V)	White
.2	AC	Black
.3	IS	Blue

.4 Raceway shall be sized for 40% wire fill.

2.19 CONSTRUCTION

.1 Minimum NEMA 12 construction for all panels unless otherwise specified.

.2 Unless otherwise specified fabricate floor mounted panels, indicated, of high grade, cold rolled smooth sheet metal steel no thinner than 3 mm thick with all doors and edges neatly turned and finished smoothly. Visible welding seams will not be accepted.

.3 Construct rigid panels and racks with an angle iron or channel supporting frame, suitably braced, and stiffened to prevent any deformation during shipping or installation, and provide a surface free from dents, warping or other deformation. Provide a four-sided channel iron mounting base with front recess.

.4 Provide flush fitting, gasketted doors hung on piano type hinges with three-point latches and locking-type handles (CSA Type 12 construction).

.5 Provide pans and rails for mounting terminal blocks, relays, wiring and other necessary devices.

.6 Use rear connected fittings to hold equipment and instrument cases on the panel, but where not possible; any front fixing required shall be only by means of chrome-plated, brass, or stainless-steel machine screws.

.7 Panel surfaces shall be thoroughly cleaned and degreased before painting. One primer coat shall be covered by two finished paint coats.

.8 The surface finish shall be free of runs, drops, ridges, waves, and laps. The paints shall be applied in such manner as to provide an even film covering corners and crevices. The interior finish shall be white, and the exterior finished will be selected after award of the contract.

.9 Panel Accessories: a metal pocket, 250 mm wide x 150 mm high x 25 mm deep, to hold pertinent drawings and manuals on the lower half of the inside door.

2.20 INTERNAL WORKS

.1 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120-volt supply.

.2 Make all wiring connections in the shop from the equipment mounted on the panel to numbered terminal blocks conveniently located in the panel, including the power supply for all instruments. Conductors shall be extra flexible stranded

copper of gauges sufficient to carry the required currents and shall in no case be smaller than #16 AWG extra flexible.

.3 Wire connections to all relays and instruments shall be made using easily removable good quality mechanical clips.

.4 Identify all wiring by means of plastic slip-on type markers. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, and where practical, contained in plastic wiring channels with covers.

.5 Provide Weidmuller terminal blocks #SAK 2.5, T7 Carrier & EK 2.5N Grounding, tubular clamp, 300 V, complete with track. Each terminal shall be clearly indelibly marked with the wire number connection to it. Each field connecting conductor shall be served by one terminal. Provide 20% spare unit terminals, with a minimum of two spare terminals. Provide all necessary terminal block accessories such as manufactured jumpers and marking tape.

.6 Mount all internally mounted equipment on a hinged sub-chassis or mount on a rack and arrange for ease of access and removal when necessary.

.7 Arrange all terminal blocks in the panel in groups such that all low level signals such as 4-20 mA DC are located in one area, followed by contact closure type signals (limit switches, etc.), that do not subsequently energize starters, etc. but are for status indication, and the remainder that contain powered circuits, 120 volt, 60 Hz, are to be arranged in such a manner and location so as to prevent interference into the low level signal.

.8 Submit proposed terminal block layout and identification scheme for review prior to manufacture.

.9 Provide suitable spaces around the terminal blocks for incoming and outgoing conductors or cable assemblies.

.10 Provide plastic cable troughs equal to Panduit complete with snap-on covers for containing the cables. Cables are not to be bunched and tied, but laid in. Wire fill not to exceed 40%.

2.21 LABELLING

.1 Panel terminal labels to be black writing on white background.

.2 Wire labels to be PVC material with black writing on white background, securely fastened to prevent movement on wire or cable. Wieland type Z5 or Weidmuller type Z or similar.

.3 Each major component inside and on the face of the control panel to be labeled with a Lamicoid label, white lettering on black background, minimum text size to be 5mm high.

.4 Terminals shall be grouped for clarity and a Lamicoid label or DIN-rail mounted label block provided for each group. For example: Terminals for slot 2 discrete input PLC card may be grouped together with label as follows; TB1 (DI).

.5 Each terminal block in each group should be numbered with individual snap-in labels such as Weidmuller Dekterm markers or similar.

.6 Label the front of the control panel with engraved Lamicoid nameplates, 20 mm x 75 mm, white lettering on black background.

.7 WRITE ON LABELS ARE NOT ACCEPTABLE.

2.22 PANEL MANUFACTURER

.1 A new Panel is not anticipated for supply by the Contractor; this spec is to be followed for any vendor-supplied equipment.

.2 Panel assembly, subcomponents and all internal components shall be CSA approved. Cabinet construction shall be performed by an established panel manufacturer who shall comply with all building codes, factory, and Department of Labour regulations and has CSA approval as manufacturer for all components of the work including control panels. Local approvals for panel construction including CSA will not be accepted.

.3 Panel manufacturer shall have successfully completed a minimum of five (5) water and / or sewage treatment plant projects of a similar scope and complexity in the past 24 months.

.4 Panel manufacturer shall have full CSA approval as manufacturer for all components of the work.

.5 Acceptable panel manufacturer shall be in British Columbia and showcase experience with Allen Bradley Compact Logix PLCs.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices as indicated, and interconnect as indicated.

3.2 CONTROL SYSTEM DISRUPTION

.1 All shutdowns shall be coordinated with operations and maintenance.

3.3 GENERAL

.1 Field measure all back pans and equipment to be relocated. Advise Engineer of changes and submit shop drawings. Modify panel layout to suit.

.2 Install Ethernet taps cabling.

.3 All AC, DC and intrinsically safe wiring shall be run in separate raceways.

.4 Install a maximum of one wire per terminal.

.5 Install terminal cross connects where required. Do not install jumper wires.

.6 Label all terminals and devices.

.7 Label all wire and cables as defined in related sections.

.8 Mount Lamicoids using self-tapping Stainless-Steel screws. Do not mount on removable covers.

.9 All devices to be protected with either fuses or breakers.

.10 All I/O to be protected with fuses including relay coils and contacts, discrete inputs and outputs and analog inputs and outputs.

.11 Control panel junctions shall be made using terminal blocks. Wire splices shall not be allowed.

.12 Communication and signal circuits shall not be installed in the same conduit with power and lighting circuits.

.13 Only commercially prepared wire-pulling compounds approved by cable manufacturers will be used. The use of soaps, soap flakes, detergents or similar preparations will not be allowed.

.14 Each wire entering a box shall be left with at least 200 mm of wire clear of the box after splicing to facilitate future alterations. Through wires in a box shall be 150 mm between the box and bottom of loop.

.15 Each terminal shall be uniquely identified and labeled.

.16 Each wire shall be tagged at both ends. The tag shall correspond with labels provided on engineering design drawings. Mark up one set of drawings with added/modified tags for review by the Engineer.

3.4 INSPECTION AND TESTING

.1 The Owner and Engineer reserves the right to inspect and witness test the control panels.

.2 Inspection:

.1 The Engineer shall be notified at least one (1) day prior to the completion of the panel layout so that arrangements can be made to inspect the panel before commencement of wiring. Provide progress photographs (digital format) to the Engineer at this stage. Progress photographs shall be sent via e-mail.

.2 The Engineer shall be notified at least seven (7) days prior to the completion of the panel so that arrangements can be made for final inspection and testing. Provide progress photographs (digital format) to the Engineer at this stage. Progress photographs shall be sent via e-mail.

.3 The inspection of the panel shall include but not be limited to the following:

.1 General workmanship (including physical dimensions).

.2 Panel painting.

.3 Arrangement of the panel.

.4 Nameplates and tagging of all panel components, instruments, control switches, indicating lights, wires, terminals, relays, and auxiliary equipment.

.3 Testing:

.1 Prior to the arrival of the Engineer, the panel shall have been completely tested by the Panel Fabricator as follows:

.1 All electrical circuits checked for continuity, and compliance with the specification.

.2 All symbols and nameplates checked for correct spelling and size of letters.

.3 All lamps tested.

.4 Mechanical features (doors, hinges, latches, etc.) shall be free from defects.

.5 Finished surfaces shall be free from defects.

.6 The Panel Fabricator shall perform all other tests as required to place the panel in operating condition. Completion of these tests shall be submitted to the Engineer in writing.

.2 The Contractor shall allocate adequate space, facilities, and assistance to permit inspection and testing to the satisfaction of the Engineer. Test instruments and equipment, test leads, temporary wiring, tools, etc., shall be made available, by the Contractor, as required. All the above items are to remain the property of the Contractor.

.3 Provide a technician for two (2) eight (8) hour days to assist the Engineer in testing the panel.

.4 All calibration/test equipment shall have a current certification of calibration. All the facilities, assistance, equipment, materials, and arrangements shall be provided at no additional charge to the Engineer.

.5 During functional test, the Engineer shall develop a deficiency list of items to be completed before the panel is accepted and shipped.

.6 The test of the panel shall include but not be limited to the following:

.1 All circuits with timing relays.

.2 All interconnecting circuits with sequencing functions.

.3 AC and DC power distribution.

.4 All auxiliary equipment.

.5 All control switches and indicating lights.

3.5 PACKAGING AND SHIPPING

.1 In accordance with Section 01 33 00 – Submittal Procedures.

.2 The panels shall be prepared for shipment to protect it from physical damage. Assemblies shall be packaged in generously padded cartons or containers. Partial shipment shall only be allowed by written approval of the Engineer.

.3 All shelf-mounted instrumentation shall be removed from the panel before shipment and re-packaged in its original containers for shipment to the job site.

.4 Any other "loose" components shall be taped or tied down, and/or supported with polyurethane foam to provide a tight, vibration free shipping unit.

.5 In addition to the District’s company name and the shipping destination, the outside of each crate or carton shall be marked with the Purchase Order and Item Number(s). A label listing the contents and a duplicate listing shall be included inside the package.

3.6 TESTS

.1 Thorough testing of the communications system shall be done prior to completion of field installation of equipment. The Contractor shall demonstrate that PLC components are operational and meet the specifications by means of tests carried out at different points of time.

.2 The complete testing process shall follow this sequence:

.1 Contractor Testing of I/O back to PLC

.2 Contractor will support testing of control system

.3 Site Acceptance Test (SAT)

.4 14-Day Acceptance Period after Commissioning

.3 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.

.4 Upon completion of sectional test, undertake group testing.

.5 Check out complete system for operational sequencing.

.6 Record Network/Segment measurements on commissioning test forms and include in commissioning manuals.

.7 Submit one copy of test results to the Engineer.

3.7 COMMISSIONING

.1 The Contractor shall be responsible for the commissioning support of the systems during the project.

.2 The Contractor shall perform all panel start-up and commissioning.

.3 PLC and HMI programming is the responsibility of the Contractor. Programming will be based on the work package and operation requirements of the District.

.4 Site Acceptance Test (SAT)

.1 System Test

.1 Test communication links for specified performance

.2 Test all wiring made to existing control panels

.3 Test all manual and automatic controls for complete operation

.4 Test all alarms to PLC for proper operation - contacts to open on alarm

.5 Test PLC-imitated callout system on alarms

.6 Test all discrete PLC inputs for proper operation

.7 Test all analog PLC inputs for proper operation

.8 Force all discrete outputs to test for correct wiring and operation

.9 Test all automated sequences

.5 14-Day Acceptance Period After Commissioning

.1 A 14-Day Acceptance Period after Commissioning shall commence at the discretion of the Engineer and after successful completion of SAT. During this period, the system will be monitored for proper operation and to ensure compliance with the availability criteria.

.2 In the event of a malfunction or a failure to meet the reliability criteria, the Client will terminate the Site Acceptance Period until the Contractor remedies the deficiency. The Site Acceptance Period shall then begin again and continue for a period of fourteen (14) days. This process shall continue until the system performs satisfactorily for fourteen (14) consecutive days in complete compliance with the specifications.

END OF SECTION

Part 1 General

1.1 UNIFORMITY OF INSTRUMENTS

.1 Instruments of one manufacturer to be used throughout the installation to the extent practical. Instruments of similar make and model to existing site equipment to be used throughout the installation to the extent practical. Variations will be permitted only where the major supplier cannot supply an instrument as specified in the instrument specifications.

.2 Note that where specifications specify a variety of instrument manufacturers, these are to establish standards of quality.

1.2 SCOPE

.1 This section specifies the supply installation, field testing, and placing into operation of flow, pressure, temperature, level turbidity, and other instruments of control and instrumentation.

1.3 RELATED WORK

.1 Section 26 05 01 – Common Work Results – Electrical.

.2 Section 25 14 00 – Control Panels.

1.4 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the control 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 3.0 m of the original location.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures. Product data sheets to include:

.1 Component electrical characteristics.

.2 Performance criteria.

.3 Physical size and limitations.

.2 Include instruments literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Manufacturer's Instructions to indicate special handling criteria, installation sequence, cleaning, and maintenance procedures.

Part 2 Products

2.1 INSTRUMENTS

.1 Provide each instrument with mechanisms that are corrosion resistant.

.2 Provide each instrument with mechanisms enclosed in a dustproof and a moisture proof case.

.3 Provide all indicator and gauge dials finished in permanent white with black graduations and figures.

.4 Potentiomeric signals shall have a "live" zero or positive minimum value in the signal range.

.5 Each component shall be carefully selected and designed for a long lifetime with ample margin to withstand transient and other surge voltages, which may occur in the circuits from any source in the power supply.

.6 Each component and composite instrument shall be suitable for the location and installation position at the attitude designated on the drawings, e.g., horizontal, vertical, or sloped position.

.7 The Contractor shall provide all power supplies. Provide each instrument having a 120-volt supply with a receptacle and plug assembly. Receptacles and plug to be of "twist-lok," type.

.8 Provide each instrument with a circuit breaker.

.9 All control panel mounted instruments shall be suitable for flush mounting and shall be furnished with bezel.

.10 Unless otherwise indicated or specified, all signals shall be of the 4-20 mA DC type. This applies to both transmitting and receiving instruments.

.11 All materials shall conform to the standards of the Canadian Standards Association (CSA).

.12 A minimum of one paper copy of each unique manual shall be provided.

.13 Where instruments require a hand-held programmer for setting up and calibrating, one of each unique programmer shall be provided.

.14 Instruments of one manufacturer to be used throughout the installation to the extent practical.

.15 Refer to Instrument Index and Instrument Data Sheets in this section.

.16 Where indicated on P&ID drawings, provide instruments with block valves, block and bleed valves, or 3-valve manifolds.

.17 Use 316 stainless steel valves on stainless steel piping, bronze-body valves on carbon steel or copper piping, and PVC ball valves on PVC piping unless specified otherwise.

.18 All pressure gauges, transmitters and switches shall be installed with a gauge/root valve equal to Whitey SS-6NDGM12-F8 complete with bleed valve SS-BVM8 and SS-½ inch plugs as required.

.19 All instrument tubing and fittings will 316 SS. All fittings will be Swagelok compression type unless otherwise specified.

.20 Any instruments encountering potable water that carries on through to distribution will have NSF 61 / ANSI 61 certification. Alternatively, they will be rated as hygienic or sanitary and a case will be made to treat them as equivalent to NSF 61 / ANSI 61.

.21 Any instruments that are do not encounter potable water for distribution do not have to be NSF 61/ ANSI 61 certified.

2.2 MAGNETIC FLOW METERS

.1 Magnetic flow meters for applications where there is at least three diameters of straight pipe upstream and two diameters of straight pipe downstream of the flow meter shall be complete with signal converters and shall be one of the following series or an approved alternative.

.1	ABB	FXE4000 (COPA-XE/MAG-XE)
.2	Endress+Hauser	PROline Promag 50 W
.3	Rosemount	8700
.4	Siemens/Sitrans	MAG 5000/MAG 5100
.5	Toshiba	LF430
.6	Krohne	Optiflux

.2 Magnetic flow meters for applications where there is less than three diameters of straight pipe upstream and two diameters of straight pipe downstream of the flow meter shall be complete with signal converters and shall be the following series or an approved alternative.

.1	Toshiba	LF430
.2	Krohne	Waterflux (316SS body only)

.3 Flow meters shall have the following features:

.1 Continuous zero stability.

.2 Interchangeability with signal converters without calibration performance.

.3 End connections shall be compatible with process piping specifications and drawings.

.4 Grounding as specified by the flow meter manufacturer.

.4 Flow meters shall have the following features:

.1 Signal converters shall have the following features:

.1 CSA Zone 2 Groups A, B, C & D certified and F.M. approved

.2 Flanges: Carbon steel, flanged each end

.3 Liner: Polyurethane

.4 Electrodes: 316 stainless steel

.5 Enclosure: NEMA 4X

.6 Product temperature: -10 to 50°C

.7 Ambient temperature: 10 to 50°C

.8 Continuous zero stability.

.9 Solid state electronics.

.10 Direct reading range adjustment permitting precise manual selecting of maximum flow rate.

.11 A local indicator that simultaneously displays instantaneous flow and totalized flow.

.12 Output analog signal proportion to the instantaneous flow, 4-20mA.

.13 Interchangeability with any flow meter without affecting calibration performance.

.14 Local display: instantaneous flow in litres per minute and totalizer in cubic metres

.15 Field mounting design.

.16 The combined accuracy off the flow meter and converter shall be within 0.5% of the actual flow rate, when the actual flow rate is between 10% and 100% of the maximum flow setting.

.5 Provide pipe spool pieces for the in-line replacement of each flow meter. Spool piece tube and end connections shall conform to the process piping specifications and drawings.

.6 The in-line mechanical installation of magnetic flow meters and turbine meters is specified under process mechanical specifications and scope. Install per manufacturers installation instructions and process mechanical specifications.

2.3 HYDROGEN DETECTOR

.1 Install, calibrate, and commission a hydrogen detector (chlorine room). The equipment is supplied by the chlorine skid generator vendor.

.2 Contractor to provide one calibration kit. This kit will be left at site.

2.4 BUILDING FLOOD ALARM

.1 Building flood alarm (high level in the flocculation tanks) and backwash flood alarm switch shall be ultrasonic gap type.

.2 LSH-101 is not showcased in a datasheet. This equipment to be a NEMA4x enclosure and be 24Vdc (if separately powered).

.3 LSH-102 is not showcased on a datasheet or on the P&IDs; the intent is to monitor for a flood in the backwash pump vault and is installed to measure for water extending 75mm above the floor.

2.5 BUILDING SMOKE DETECTORS

.1 A smoke detector shall be installed in each functional area. All the output contacts are to be wired in series and connected to one input of the central PLC. Smoke detectors shall be powered from 24 Vdc, be dual ionization type and shall have one form C output contact. Smoke detectors shall be model ASD100KA as manufactured by American Sensors or an approved alternative.

2.6 LEVEL MONITORING SYSTEMS

.1 Ultrasonic Level Transmitter

- .1 Level monitoring Transmitters
- .2 The level system shall be the following or equivalent product:
  - .1 Siemens (Milltronics) model Sitrans Echomax XPS-15 w/ Sitrans MultiRanger 100,
  - .2 Endress and Hauser Prosonic M series
  - .3 Siemens Sitrans Probe LU
- .3 Controller shall have local display, analog output and adjustable high- and low-level alarm setpoints.
- .4 Each alarm output shall be a Form C contact driven by a relay that de-energizes on the alarm condition.
- .5 The reservoir Ultrasonic level transmitter shall have the transducer mounted separately from the controller (transmitter).
- .6 Output analog signal will be linearly proportional to the level.
- .7 Indicator will have linear scale in units of mm.

.2 Point Level Control Systems

.1 Point Level Transmitters

.2 The level system shall be the following or equivalent:

.1 Siemens Pointek ULS200 (point level, LSC-116 only)

.2 Siemens (Milltronics) model Sitrans Echomax XPS-15 w/ Sitrans MultiRanger 100,

.3 Endress and Hauser Prosonic M series

.4 Siemens Sitrans Probe LU

.3 Controller shall have local display for programming and adjustable latch/unlatch and high alarm setpoints.

.4 Two outputs are to be provided, both being Form C contacts providing a start/stop signal as well as a high-level signal.

.5 Power to be 24Vdc. If 24Vdc not used, 120Vac system installation shall be accounted for in price (including wiring and source)

.3 Level Switches

.1 For non-NSF 61 / ANSI 61 rated devices, level switches shall be ENM-10 Liquid Regulators, standard version, as manufactured by Flygt Canada or an approved alternative. Switches shall not contain any mercury.

.2 For NSF 61 / ANSI 61 rated devices, level switches shall be Endress and Hauser Liquiphan M FTL51 series or approved equivalent.

.3 Install as shown on Process Mechanical drawings.

.4 Suspend the bulb the appropriate distance above the bottom of the channel to obtain the desired switching point.

.5 For level switches sensing a high level, the switching point is defined by a rising water level

.6 For level switches sensing a low level, the switching point is defined by a falling water level.

.7 Protect level switches from turbulence during equipment operation.

.4 Sump Moisture Detection

.1 To detect leaks in the NaCL dosing system, contractor to supply and install a point level detection within the Secondary containment tank to provide level feedback to the control system. Equipment to withstand exposure to Sodium Hypochlorite (10% concentration).

2.7 ISOLATION VALVES

.1 Each instrument sensing line shall be complete with an isolation valve. The isolation valves shall conform to Division 40 - Process Mechanical.

2.8 PRESSURE MONITORING SYSTEM

.1 Pressure transmitters shall have the following features:

.2 Loop powered by 24 Vdc.

.3 Output analog signal shall be 4 to 20 mA and linearly proportional to the pressure.

.4 Where an Indicator is required, it shall have a linear scale in units of kPa.

.5 Pressure transmitters shall be manufactured by ABB, Endress + Hauser, Rosemount, Siemans, Toshiba or an approved alternative.

2.9 SUPPLIED EQUIPMENT

.1 Contractor responsible for confirming with all trades to ensure electrical discipline is made aware of all equipment that is to be wired and supported for commissioning. Basic drawings are provide showcasing the vendor-supplied equipment and the equipment that is required for purchase and installation.

Part 3 Execution

3.1 INSTALLATION

.1 Coordinate the work of this Section with the installation of the equipment specified in the relevant Sections and as shown on the Mechanical and Electrical drawings.

.2 Perform all work in compliance with the relevant sections of this Section.

.3 Ensure that exit light circuit breaker is locked in on position.

.4 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. Any damage resulting from failure to observe the manufacturer's instructions or because of proceeding with the work without complete knowledge of a component will be the Contractor's responsibility. The Contractor to make good any loss or damage resulting from malpractice.

.5 Where the manufacturer recommends the use of special tools or jigs for installation or calibration, use such tools.

.6 Where the manufacturer requires to inspect the work before certifying the instrument, co-operate to permit such inspection.

3.2 CONDUIT AND CONDUCTOR INSTALLATION

.1 Refer to Division 26 for conduit and conductor installation and precautions during construction.

3.3 CABLE INSTALLATION

.1 Control and instrumentation cables shall be supported on horizontal cable trays by means of nylon cable ties at intervals not exceeding 1 m.

.2 Control and instrumentation cables shall be supported on vertical cable trays by means of cable clamps. The Contractor shall be responsible for selecting the proper size clamp for each cable.

.3 Cables leaving the cable tray system shall be supported to the building walls by means of c-channel and cable clamps or approved alternative.

.4 Wall support not to exceed an interval of 1 m. The length of the supports to be 150 mm minimum.

.5 Cable installation from the building wall to the control or instrumentation device exceeding 0.5 m shall be supported by means of c-channel, supported to the wall and at the device. Cross channel for the support of the Series M-5000 cable clamps to be bolted to the main channel. Cross channel not to be wider than is required for the cable clamp. All channels and supports painted black.

.6 Channels for cable support from building walls shall be painted the same colour as the walls. Cables and cable clamps not to be painted.

3.4 FIELD INSTRUMENT MOUNTING

.1 "Mounting" shall mean the positioning and fastening with proper brackets in the position required.

.2 All equipment shall be mounted in accordance with manufacturer's recommendations.

.3 Locations of all field instruments are subject to modification by the Engineer who reserves the right to move any item up to 3 meters from the position shown, without change to the contract price, provided notice is given before the related work has commenced.

.4 Exact locations of all field instruments shall be site determined by the Contractor to the satisfaction of the Engineer to ensure proper operation of the device.

.5 Employ all means of trade, skill, and workmanship to install all field instruments to the satisfaction of the Engineer.

3.5 COMMISSIONING

.1 Instrument manufacturer’s qualified field service representative shall be onsite as required to perform instrument calibration, testing and commissioning and to instruct Owner’s representatives in all aspects of instrument operation and maintenance.

.2 Follow all commissioning requirements of these specifications.

.3 The Contractor is responsible for fully commissioning the installed equipment and providing a functional system to the Owner.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 All Sections of General Conditions form a part of this Specification. They shall be read and fully adhered to exactly as if repeated here in full.

.2 Refer to all other Sections of the Specifications and the Contract Documents to determine their effect upon the work of this Section.

1.2 SCOPE

.1 A brief but not necessarily all-inclusive list of work to be performed under this contract is given herein.

.2 The Contractor shall supply all labor, material, equipment, transportation, services, and facilities necessary to make, test and place into operation a complete electrical installation as shown on the drawings and/or as specified herein.

.3 Where the term "provide" is used herein, it shall mean "supply, install, adjust, test and place into operation".

.4 All systems shall be completely assembled, adjusted, tested, and demonstrated to be ready for operation to the satisfaction of the Engineer.

.5 The Contractor shall carefully examine the drawings and specifications and shall fully inform himself as to all existing conditions and limitations, including all laws, ordinances and regulations affecting the contract and the work and shall include in his tender all items implied or required to complete the work of this contract.

.6 The Contractor shall satisfy himself as to working space, storage space, access facilities and all other conditions pertaining to the site, relating to the conduct of his operations, by the inspection of the site and examination of the drawings.

.7 Provide all labor and materials as necessary to install, wire, connect and put into satisfactory operation the following electrical equipment, control panels and process and mechanical equipment supplied under this and other Sections of this specification:

- .1 Motor Control Centre modifications,
- .2 PLC modifications (I/O terminations, PLC programming, SCADA programming),
- .3 Installation and commissioning of all vendor-supplied equipment,
- .4 Motor starters, contactors, and interlocks where specified as components of "packaged" equipment,

.5 Electrical distribution equipment, such as 600V panel board, and

.6 Various other electrical systems, including lighting, receptacles, switches, and controls.

1.3 EXTENT OF WORK

.1 This work shall consist of furnishing of all labor, material, equipment, and all incidentals required for the District of Sooke WWTP Dewatering Area (Facility).

.2 Work at the Facility shall include, but not be limited to:

.1 Modifications to existing facilities, including:

.1 Reconnection of electrical supply to reoriented centrifuge #1,

.2 Removal of existing conveyor and polymer system,

.3 RE-used of sludge pump flow meter (install on new line, replace wiring if required for length and clean installation to new transmitter location),

.4 Addition of electrical relating to canopy building addition,

.5 Additional distribution equipment including but not limited to: 600V panel board and wiring,

.6 Addition of MCC breakers, wiring and distribution for vendor packages,

.7 Installation and wiring of vendor panels detailed in the work package,

.8 Wiring of new tankless water heater (electric). Coordinate with Div 22 and ultimate size of heater for tender pricing,

.9 Supply and installation of cable tray extensions for Teck and armoured cabling,

.10 Supply and installation of all power, control, and instrumentation wiring for pre-purchased and new process systems,

.11 Supply and installation of all building electrical services, including lighting, receptacles, and communications,

.12 Supply and installation of all grounding systems,

.13 Supply and installation of PLC-based control system, including programming services,

.14 Programming of PLC and SCADA to accommodate new systems,

.15 Commissioning of all equipment to an operating state, and

.16 See contract drawings for further details.

.3 Wire to and make connections to, all electrical power and control items required, including motors, and controls.

1.4 EXAMINATION OF DRAWINGS

.1 The electrical drawings do not show all architectural, mechanical, and structural details. All electrical schematics are shown diagrammatically unless otherwise noted. The Contractor shall review the mechanical and structural drawings to obtain building dimensions and details. Verify dimensions accurately by measurements.

.2 There are many underground conduits required that are not shown on the plan drawings but are referred to in notes and listed on the cable schedule(s). Contractor shall review the underground conduit requirements and provide sketch of proposed layout for Engineer review, prior to installing.

.3 To change the location of electrical equipment, submit a request in writing to the Engineer for approval. If approved, such changes are to be made at no additional cost to the District.

.4 No extra will be allowed for any additional labor or materials required for relocation of equipment due to interference with equipment of other trades, beams, joists, walls, etc., unless the conflict has been submitted to the Engineer in accordance with these Specifications.

1.5 APPROVED DESIGN AND INSTALLATION

.1 Equipment and material to be of approved design and manufactured in accordance with all governing regulations such as "Canadian Standards Association", "Canadian Electrical Code", "Provincial Department of Labor", "Underwriters Laboratory", etc. Equipment and material must bear applicable acceptance labels of all associations and governing bodies recognized by the municipal, provincial, and federal authorities.

.2 Install equipment in strict accordance with manufacturer's recommendations and governing rules, regulations, and codes.

.3 Where requirement conflict occurs, install all materials in accordance with the most severe requirements.

.4 Material installed under this Section to be new and of uniform construction.

.5 All installation to ensure maximum headroom, minimum interference with free use of surrounding areas, and best access to equipment.

.6 For any deviations of major service runs and/or feeder cabling from the locations shown on the drawings, Contractor shall submit to the Engineer suitable drawings showing such deviations together with reasons for deviations and obtain approval from the Engineer before proceeding with the installation.

1.6 CODES AND STANDARDS

.1 Do complete installation in accordance with the latest edition of the Canadian Electrical Code, as adopted for the province of British Columbia, and Provincial, Municipal, and other codes, rules and regulations, and requirements of the local authorities having jurisdiction.

.2 Perform all work in accordance with drawings, specifications, applicable municipal and provincial regulations, and any pertinent inspection bulletins issued by the electrical inspection authority having jurisdiction over the installation. In no instance shall the standard established by the drawings and specifications be reduced.

.3 Provide a copy of all standards referred to in this Section for use on site.

1.7 PERMITS, FEES, AND INSPECTION

.1 Submit to the Town of Lake Cowichan authorities having jurisdiction, the necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to the Engineer.

1.8 ABBREVIATIONS

.1 Abbreviations for electrical terms shall be to CSA Z85 1983.

.2 Names used throughout these specifications are:

.1 EEMAC: Electrical & Electronic Manufacturers Association of Canada (formerly CEMA)
.2 CSA: Canadian Standards Association
.3 FM: Factory Mutual
.4 NEMA: National Electrical Manufacturers Association (U.S.)
.5 JIC: Joint Industry Conference
.6 IPCEA: Insulated Power Cable Engineers Association
.7 ISA: Instrument Society of America
.8 CEC: Canadian Electrical Code
.9 IEEE: Institute of Electrical and Electronic Engineers
.10 IES: Illuminating Engineering Society
.11 NBC: National Building Code

.12 ANSI: American National Standards Institute

1.9 SHOP DRAWINGS

.1 Submit shop drawings in accordance with these Specifications and (01 33 00).

.2 Submit shop drawings for all equipment as indicated, except for conduits, standard conduit fittings and low voltage wiring.

.3 Indicate on shop drawings details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.4 Where applicable, include wiring, single line, and schematic diagrams.

.5 Wiring drawings showing interconnection with work or other sections are required.

.6 Indicate the numbered and lettered tags shown on the drawings for identification symbol(s) on submitted shop drawings and product data for panelboards, lighting fixtures and other electrical equipment.

1.10 OPERATION AND MAINTENANCE MANUALS

.1 Include in the manual's information based on following requirements:

.1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of installation.

.2 Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.

.3 Advertising or sales literature is not acceptable.

.4 Provide wiring and schematic diagrams and performance curves.

.5 Include names and addresses of local suppliers for all items included in the operation and maintenance manuals.

.2 Submit six (6) complete copies of manuals and "as-constructed" drawings to the Engineer for review. Revise initial manual as required by the Engineer prior to final submission.

1.11 RECORD DRAWINGS

.1 Submit record drawings in accordance with Section 01 78 00 - Closeout Submittals.

.2 The Contractor shall record all changes made during construction and provide red-lined record drawings to District upon completion of the work.

.3 At the completion of the project, the Contractor shall submit one (1) set of record drawings on disk, accurately recording all changes, deviations and relocations necessitated by job conditions and equipment approved shop drawings all done with red pen to full sized drawings. A second copy to be left at site.

.4 Include with the record drawings a list for each motor indicating motor or equipment number and name, nameplate voltage, horsepower and current, the size of overload and breaker or fuse protection provided.

1.12 DEFINITIONS

.1 The following are definitions of terms and expressions used in the specification:

.1 "Inspection Authority" means agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical work on site.

.2 “Supply Authority" means electrical power company or commission responsible for delivery of electrical power to project.

.3 "Electrical Code" means latest edition of the Canadian Electrical Code C22.1 or code in force at project location.

.4 "Indicated" means as shown on contract drawings or noted in contract documents.

.2 Refer to CSA C22.2 for "Definitions and General Requirements".

1.13 COOPERATION AND COORDINATION

.1 Schedule expediting of all materials and execution of work with associated work specified in other Sections.

.2 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 galvanized steel pipes, sized for free passage of conduit, and protruding 50 mm (2").

.3 Cables, conduits, and fittings to be embedded or plastered over neatly and close to building structure so furring can be kept to a minimum.

.4 Arrange for holes through exterior walls and roof to be flashed and made weatherproof.

1.14 SOURCE QUALITY CONTROL

.1 Arrange for a plant inspection by the Engineer where specified.

.2 Inform the Engineer of manufacturing progress and arrange inspections at appropriate times.

.3 Action required by factory inspection shall not be construed as final acceptance.

.4 Obtain a Certificate of Acceptance from the inspection authority on completion of work and hand it to the Engineer.

.5 The Engineer may carry out inspections and prepare deficiency lists for action by the Contractor, during and on completion of project.

1.15 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.16 APPROVAL OF ALTERNATE MATERIALS

.1 Bid Opportunity shall be based on the materials, products, and manufacturers specified.

.2 Alternates to materials, products, and manufacturers specified shall be in accordance with Section 1.

.3 Supply and install all motor power wiring and conduit, all control wiring and conduit, all local and remote-control devices, and all motor starters and contactors except where specified as components of "packaged" equipment.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT - GENERAL

.1 All materials shall be fully approved by the Canadian Standards Association (CSA) or by a Provincial Inspection Authorities approved agency, for use as installed. All materials shall meet the requirements of this specification in all respects.

.2 Where there is no alternative to supplying equipment, which does not have CSA approval, submit such equipment to Provincial Inspection Authorities for special inspection and obtain approval. Pay all associated fees.

.3 Materials and equipment shall be of Canadian manufacture except where specified otherwise or where Canadian made materials or equipment does not exist.

.4 Where two or more units of the same class or type of equipment are required, the units shall be the product of a single manufacturer, although components of equipment need not be products of the same manufacturer.

.5 Use material and equipment available from regular production of manufacturer.

.6 Control panels and component assemblies to be shop manufactured, assembled, and CSA approved.

2.2 FINISH

.1 Finish metal enclosure surfaces by removing rust and scale, cleaning, and applying rust resistant primer inside and outside with at least two coats of finish enamel.

.2 Paint all outdoor electrical equipment "equipment green" finish to EEMAC Y1-2, unless noted otherwise.

.3 Paint all indoor switchgear and distribution enclosure "light grey" to ASA 61 grey.

.4 Clean, prime and paint exposed hangers, racks, fastenings, etc., to prevent rusting.

2.3 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

2.4 WIRING

.1 Lugs, terminals, screws used for termination of wiring must be suitable for copper conductors.

2.5 ENCLOSURES

.1 Minimum enclosure type to be used is NEMA 12 for ordinary environments, NEMA 4X for corrosive environments and outdoor installations, unless otherwise specified.

2.6 MANUFACTURERS AND CSA LABELS

.1 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed.

2.7 WARNING SIGNS

.1 Provide warning signs with suitable background color and lettering as required to meet requirements of inspection authorities and Engineer. Use decal signs, minimum size 178 mm x 250 mm.

2.8 PLYWOOD MOUNTING BOARDS

.1 Surface wall mounted panelboards and other electrical equipment shall be installed on plywood mounting boards. Boards shall be provided under this section of the specifications, sized to suit equipment indicated and/or implied.

.2 Plywood mounting boards shall consist of 20 mm fir plywood fastened securely to wall.

.3 Plywood mounting boards, strapping and trim shall be treated with wood preservative prior to installation and painted with one coat of primer and two coats of grey enamel ASA61. Painting shall be completed before any electrical equipment is mounted on the plywood.

.4 Service entrance equipment shall be spaced from the plywood mounting boards to the satisfaction of the inspection authorities.

2.9 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

.1 Contractor and Sub-Contractor responsibility is indicated in Equipment Schedules on mechanical drawings.

.2 Control wiring and conduit is specified in Sections 26 05 21 and 26 05 34 except for conduit, wiring and connections below 50 V which are related to control systems (HVAC equipment) and shown on mechanical drawings.

2.10 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self-tapping screws.

.2

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters

NAMEPLATE SIZES			
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Allow for average of twenty-five (25) letters per nameplate.

.4 Identification to be English.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, impedance, primary and secondary voltages.

2.11 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and color coding throughout.

.3 Color code: to CSA C22.1.

.4 Use color coded wires in communication cables, matched throughout system.

2.12 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes, unless otherwise detailed in the drawing package.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.3 Locate light switches on latch side of doors.

2.13 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In process areas, chemical rooms, and mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Voice and data communication outlets: same height as nearest receptacle.

2.14 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

2.15 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits, and fittings to be embedded or plastered over, neatly, and close to building structure so furring can be kept to minimum.

2.16 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this section to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.

.3 Conduct and pay for following tests:

.1 Power distribution system including phasing, voltage, grounding, and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Emergency lighting.

.5 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.

.6 Vendor control systems, including PLC modifications.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

.1 Megger circuits, feeders, and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders, and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.6 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Engineer's review.

2.17 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Provide a coordination study report demonstrating selective tripping and proper functionality of the power distribution system with the devices and settings as installed.

.2 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

.3 Select and adjust protective devices as required to ensure suitable coordination.

.4 Provide a coordination study report demonstrating selective tripping and proper functionality of the power distribution system with the devices and settings as installed.

2.18 ARC FLASH SAFETY LABELING

.1 Provide an arc flash study for power distribution system using devices and settings as installed.

.2 Provide arc flash safety labeling on electrical equipment in accordance with CSA - Z462.

Part 3 Execution

3.1 WORKMANSHIP

.1 All work to be carried out by qualified journeymen of the related trades.

.2 Where sheet metal enclosures are not provided with knockouts, Greenlee punches shall be used in all cases. Cutting torches shall not be used for making holes.

3.2 INSTALLATION

.1 Determine manufacturers' recommendations regarding storage and installation of equipment and adhere to these recommendations.

.2 Check all factory joints and tighten where necessary to ensure continuity.

.3 Coordinate the work of this Section with the installation of the equipment specified in the relevant Process and Mechanical Sections and shown on the Process, Mechanical and Electrical drawings.

.4 Perform all work in compliance with the relevant sections of this Section.

3.3 SPECIAL PROTECTION

.1 Accept the responsibility to protect those working on the project from any physical danger due to exposed electrically energized equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts "LIVE 600 VOLTS" or with the appropriate voltage.

.2 Arrange for the installation of temporary doors, barriers, etc., for all electrical equipment. Always keep these doors locked, except when under direct supervision.

3.4 FIREPROOFING

.1 Where sleeves or openings are installed in walls, floors, roof or partitions to accommodate raceways, cables or bus duct, provide all necessary seals, fittings, barriers and fire-resistant materials to restore the installation to its original fire rating to the satisfaction of the Engineer.

3.5 TOUCH-UP PAINTING

.1 Be responsible for field touch up painting of all shop painted electrical equipment installed in this Contract.

.2 All surfaces to be painted shall be dry, clean, and free from dust, dirt, grease, frost, rust, loose crystals or extraneous matter, tool, and machine marks. Feather out edges of scratch marks to make patch inconspicuous.

.3 Apply one or more coats of paint until the damaged surface has been restored to original finish condition. Do not apply succeeding coats until preceding coat is dry and hard. Sand lightly between coats with No. 00 sandpaper.

.4 Be responsible for obtaining the necessary touch up paint of the original type and quality from the equipment manufacturer.

.5 Supervise priming and finish painting of all electrical equipment and material not shop-painted.

3.6 SLEEVES AND OPENINGS

.1 Provide sleeves and openings for exposed conduits, busways, and wireways, where they pass through walls or floors conforming to relevant fire codes where applicable.

.2 Sleeves for individual conduits shall be galvanized steel in ordinary areas or stainless steel in corrosive environments.

.3 Pack or fill sleeves and openings after the completed work is in place. Filling shall provide a waterproof seal to prevent leakage of water or other liquids through the sleeve or opening.

.4 Sleeves and openings shall not displace reinforcing steel and shall receive approval of the Engineer prior to placement.

3.7 CUTTING AND PATCHING

.1 Do all drilling, cutting, fitting, and patching necessary for the running and securing of conduits, wireways, and other electrical equipment.

.2 Provide supports necessary for same.

.3 Provide bracing and anchorage of work subject to Engineer's approval.

.4 No cutting of the structural members or of the fireproofing shall be done without the written consent of the Engineer.

.5 Caulk and flash all conduits passing through walls, roofs or other surfaces exposed to weather or as indicated on the drawings to prevent the passage of water and/or sewer gases.

3.8 HANGERS AND SUPPORTS

.1 Provide hangers, angles, channels, and other supports necessitated by field conditions to install all items of electrical equipment. Design of supports and methods of fastening to building structures shall be subject to the Engineer's approval.

.2 All local motor control devices are to be grouped and mounted on a free-standing frame of stainless-steel construction easily accessible and as close to the motor as possible.

.3 Provide weight-distribution facilities, where required, so as not to exceed the load-bearing capacities of floors or walls that bear the weight of, or support, electrical items.

.4 Paint all exposed parts of hangers and supports with an anti rust inhibiting primer.

.5 Equipment shall not be held in place by its own weight. Provide base anchor fasteners in each case.

.6 Meet seismic requirements as defined in seismic specification section 16 05 50.

3.9 PROTECTION OF EQUIPMENT

.1 Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps.

.2 Fixtures, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced by the Contractor.

3.10 TESTING OF ELECTRICAL SYSTEMS GENERAL

.1 Prior to the Engineer's acceptance, all electrical equipment, materials, and systems installed shall be subject to an inspection and applicable performance tests supervised by the Engineer to ensure that the operation of the system and components satisfy the requirements of the Specifications. Refer also to Section 26 08 11 – Testing of Electrical Systems.

.2 Ensure that the system and its components are ready prior to the inspection and test for acceptance.

.3 All testing shall be conducted by fully qualified personnel only. Tests requiring initial power energization of a system shall not be made without notification of the Engineer. Tests, checks and the like carried out by or on behalf of the Contractor shall be documented and certified at no additional cost to the District. Submit six copies of the test certificates to the Engineer. Carefully check wiring for each

system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.

.4 Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.

.5 Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.

.6 In addition to tests on purely electrical systems, supply the necessary labor and equipment for operational tests required by other Sections where electrical services are involved and make final adjustments to the electrical controls at no additional cost to the District.

.7 Perform tests on auxiliary or specialized systems with the assistance of the manufacturer's representative. Upon successful conclusion of the tests, obtain a certificate from the manufacturer stating that the system has been installed to their satisfaction and that it is in good working order.

.8 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to values and settings as indicated.

.9 Supply all instruments, meters and personnel required for the tests.

3.11 CABLE AND WIRE 1000 VOLT AND BELOW

.1 Tests on cables in this voltage range shall be limited to insulation resistance measurements using a 500V megger for systems up to 350V and a 1000V megger for 351 to 600V systems.

.2 Record all test results in a logbook and submit to the Engineer for reference. Replace or repair all circuits, which do not meet minimum requirements specified in the CEC, Table 24. Insulation resistance of the following circuits shall be measured:

.1 Power, lighting, and motor feeders (with equipment disconnected): phase to phase, phase to neutral and phase to ground.

.2 Control circuits: measure to ground only.

.3 Do not perform megger tests on control circuits containing transistorized or solid-state components.

.4 Where power factor correction equipment is installed, it may be necessary to disconnect the capacitors from the system prior to testing to avoid overvoltage.

3.12 GROUNDING SYSTEM

.1 Test the grounding system efficacy for compliance with CSA Standard C22.1 and Supply Authority requirements.

.2 Notify Engineer that they may be present to witness Contractor testing.

3.13 TRAINING

.1 Provide for the training of the Owner in the operation, maintenance and testing of all systems and equipment including the provision of qualified manufacturer's technical representatives for specialized systems.

.2 Provide these services for such period, and for as many visits as necessary to put installation in working order, and to ensure that operating personnel are conversant with all aspects of its care and operation.

3.14 DELIVERY AND STORAGE

.1 Ship and store floor mounted equipment in upright position.

.2 Ship channel bases and anchor stencils in advance of equipment.

.3 Keep equipment doors locked. Protect equipment from damage and dust.

.4 Block moving parts when necessary to prevent damage during movement and shipment of equipment. Instructions to remove blocking before putting equipment in service to be clearly and conspicuously displayed.

.5 Store all electrical equipment indoors. Temperature sensitive equipment to be stored in heated spaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings, and Associated Hardware.

.2 CSA C22.2 No. 65, Wire Connectors.

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

.3 National Electrical Manufacturers Association (NEMA).

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to CSA C22.2 No.65, with current carrying parts of suitable material sized to fit conductors as required.

.2 Fixture type splicing connectors to CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors.

1.2 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

.1 Compliance: CSA C22.2 No. 38.

.2 Conductors: stranded copper for 14 AWG and larger.

.3 Minimum conductor size: 12 AWG (for power wiring) and 14 AWG (for control wiring).

.4 Copper conductors: size as indicated, with 1000 VAC insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK POWER AND CONTROL CABLES

.1 Compliance with CSA C22.2 - No. 131 Type Teck 90 Cable.

.2 Conductors:

.1 Grounding conductor, Copper.

.2 Circuit conductors, Copper, size as indicated on the drawings.

.3 Insulation:

.1 1000 V chemically cross-linked thermosetting polyethylene rated type RW90.

.2 HL rating for hazardous location Zone 1 or 2, as required, with approved TECK connectors and sealing compound.

.4 Inner jacket:

.1 Thermosetting Polyvinyl Chloride (PVC) compound.

.5 Armour:

.1 Interlocking Aluminum.

.6 Overall covering:

.1 Outer jacket of PVC material rated -40°C and meeting low gas emission and FT 4 flame test requirements set forth in CSA C22.2 - No. 0.3 and IEEE 383.

.7 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable. Dry-type not acceptable.

2.3 INSTRUMENTATION CABLES

.1 Twisted Pair Shielded Cables (TPSH) shall be Teck type armoured, CSA FT4 rated, approved for installation in cable tray and shall meet conditions from 2.2 plus:

.1 Each pair shall have two copper conductors, stranded, minimum No. 18 AWG, PVC insulated, twisted in nominal intervals of 50 mm.

.2 Insulated for 600V, 90°C.

.3 100% coverage aluminum foil or taped shield for each pair.

.4 Separate bare stranded copper drain wire for each pair, minimum No. 18 AWG.

.5 Overall shield and bare stranded copper drain wire for multi-pair cable.

.2 Continuous number coding for multi-pair cable.

.3 Connectors and fastenings shall be as specified for Teck cables, and rated for hazardous areas, if required.

.4 All analog signal cables to be TPSH.

2.4 ALUMINUM CONDUCTORS

.1 Aluminum conductors shall NOT be used.

2.5 WIRING ACCESSORIES

.1 Wire markers, black letters on white background, shall be heat shrink type as manufactured by Critchley.

.2 Cable markers for cables or conductors greater than 13 mm diameter, shall be strap on type, rigid PVC, black letters on white background, with PVC covered aluminum straps, as manufactured by Electrovert Cat. No. 510.

.3 Terminal blocks shall be minimum 600 volt rated, modular, sized to accommodate conductor size used, as manufactured by Weidmuller, Phoenix, Allen-Bradley.

.4 Where screw type terminals are provided on equipment, field wiring shall be terminated with insulated fork tongue terminals, as manufactured by Thomas & Betts, Sta Kon.

.5 Splicing of wiring and cables is not acceptable, unless approved by the Engineer. Where splices are required and approved use the following:

.1 Splice connectors for wire sizes #14 to #10 AWG inclusive, shall be of the compression spring type, as manufactured by Ideal Waterproof Type DP.

.2 Splice connectors for wire sizes #8 AWG and larger shall be split bolt type, sized to suit number and size of conductors, as manufactured by Burndy Servit Type KS.

.6 Cable ties shall be nylon, one-piece, self locking type, as manufactured by Thomas & Betts, Burndy, and Electrovert.

.7 Electrical insulating tape as manufactured by 3M Scotch 88.

.8 Cable grips shall be provided for all vertical and catenary cable suspension installations to reduce cable tension at connectors or at cable bends. The cable grips shall be selected to accommodate the type and geometry of cable supported and shall be of the single wave, variable mesh design, as manufactured by Kellems and Arrow-Hart.

.9 Cable pulling lubricant shall be compatible with cable covering and shall not cause damage and corrosion to conduits or ducts.

Part 3 Execution

3.1 INSTALLATION – GENERAL

.1 Install all wiring in accordance with the drawings, with a minimum size of #12 AWG for power cables unless indicated otherwise.

.2 Pull wire into ducts and conduits in accordance with the manufacturer's recommendations, using patented wire grips suitable for the type of wire or using pulling eyes to be installed directly onto the conductors.

.3 Limit pulling tensions to those recommended by the manufacturer to avoid overstressing wire.

.4 Utilize adequate lubricant when pulling wires through ducts and conduits to minimize wear on cable jackets.

.5 Make connections to equipment "pig tails" with mechanical, insulated, screw on connectors for wire sizes #14 to #10 AWG. For wire sizes #8 AWG and larger utilize split bolt connectors, taped with three layers minimum of insulating tape. For all terminations, wire through the conductor, apply joint compound anti-oxidant and torque to lug manufacturer's recommended torque levels.

.6 No splices shall be permitted in cable or wiring runs without the written permission of the Contract administrator and shall only be permitted in junction boxes.

.7 Neutral conductors shall be identified. Paint or other means of colouring the insulation shall not be used.

.8 Unless otherwise specified, make all wiring taps, splices, and terminations with identified compression screw type terminal blocks, securely fastened to avoid loosening under vibration or normal strain. Make connections for interior and exterior lighting circuits and convenience receptacle circuits using screw on or split bolt connectors and insulating tape.

.9 Determine the exact length of cable required to avoid splices.

.10 Identify each conductor by specified markers at each termination indicating the circuit designation or wire number.

.11 Identify each cable by attaching a suitable marker, stamped, or indelibly marked with the cable number, at each end of the cable and in all junction boxes and pull boxes.

3.2 INSTALLATION OF TECK AND INSTRUMENTATION CABLES

.1 Install cables.

.1 Group cables wherever possible on cable trays.

.2 Install cable in trenches in accordance with Section 26 05 44.

.3 Provide appropriate watertight connectors and terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Supply and installation of complete grounding system as specified herein and in accordance with Canadian Electrical Code and local inspection authority.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results for Electrical.

1.3 REFERENCES

.1 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)

.2 Canadian Standards Association (CSA).

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, soft annealed, sized to suit system amperage.

.2 Non-corroding accessories necessary for grounding system, type, size, material to suit equipment, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Rod electrodes, copper-clad steel, 19 mm diameter by 3 m long.
- .3 Inspection Test Wells.
- .4 Protective type clamps.
- .5 Bolted type conductor connectors.
- .6 Compression type conductor connectors.
- .7 Bonding jumpers, straps.
- .8 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including rod electrodes, conductors, connectors, and accessories as indicated or required to

conform to requirements of the Canadian Electrical Code, Owner's Representative, and local authority having jurisdiction over installation.

.2 Provide grounding grid for new facility as indicated on the drawings.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections and connections to electrodes, using approved compression-type connections.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Connect building structural steel and metal siding to ground by welding copper to steel in at least the four corner locations around the building.

.10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to equipment included in, but not necessarily limited to the following list: Service equipment, transformers, stand-by generator frame, switchgear, duct systems, cable trays, frames of motors, motor control centers, starters, control panels, building steel work, steel platforms and stairwells, distribution panels and outdoor lighting.

3.3 GROUNDING BUS

.1 Extend grounding to equipment from ground bus of the service entrance MCC.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size #6 AWG, or larger where required by CEC.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for voice/data communication, and security systems in accordance with CEC and specific equipment manufacturer's recommendations.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner's representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Provide test results to Owner's Representative for review.

3.6 FIELD CHECK LIST

.1 Grounding conductors are adequately protected from mechanical damage.

.2 Where buried, grounding conductors are deep enough to meet or exceed minimum code depths.

.3 Grounding conductors are mechanically and electrically secure.

.4 Grounding conductors are free of damage.

.5 Grounding connections are examined to determine if connection is both electrically and mechanically acceptable.

.6 Check that only copper conductors are used for grounding system.

.7 Confirm size of grounding conductors meets code standards.

.8 Connections to artificial or natural electrodes are electrically and mechanically secure.

.9 Connections to system distribution equipment is adequate and secure.

.10 Bonding of all metallic electrical equipment (motors, luminaires, welders, etc.) has been accomplished.

.11 Bonding of all metallic raceways (conduits, cable trays, wireways, etc.).

.12 Bonding of metal gas lines, water lines, sewer lines and telecom systems has been done.

.13 Isolated grounds have been connected to the bonding bus of the distribution system.

.14 Structural steel and steel supports have been bonded.

.15 The bonding screw of the identified conductor terminal (neutral) has been removed from all distribution panelboards.

.16 Service neutral conductor is grounded.

.17 Neutral conductors on the secondary of transformers are grounded.

.18 Transformer cores and cases are bonded.

.19 All flexible raceways have a separate bonding conductor placed within the flexible raceway.

.20 A bonding jumper is present between the metal outlet box and the receptacle. A bonding conductor is present for the receptacle.

.21 Mounting straps of receptacles and switches must be bonded. Spacers used on mounting screws must not impede bonding of mounting strap.

.22 Continuity of the entire grounding and bonding system.

.23 Surge arrestors are grounded to earth.

.24 Alternate power supplies (standby generators, UPS, etc.) are adequately grounded and or bonded.

.25 Secondary of instrument transformers are grounded.

.26 Cables supplying motors have adequately sized bonding conductors.

.27 Metallic raceways placed in the ground or in concrete contain a bonding conductor.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnish all labour, materials, equipment, and services specified, indicated, or requested to install the electrical boxes specified herein and as indicated on the drawings.

1.2 REFERENCES

.1 Refer to Section 26 05 01 – Common Work Results for Electrical.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Section 26 05 01 - Common Work Results for Electrical.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

2.6 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Refer to Section 26 05 01 Common Work Results for Electrical.

.2 Furnish all labour, materials, supervision, equipment, and services specified, indicated, or requested to install a complete conduit raceway system. The raceway systems shall be comprised of the supply and installation of all conduits, fittings, supports, hangers and miscellaneous support materials and hardware required.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 LOCATION OF CONDUIT

.1 The drawings do not show every specific conduit run. All wiring shall be surface and as run in the slab unless otherwise indicated in the specifications and/or shown on the drawings. All devices shall be surface mounted type except as shown.

Part 2 Products

2.1 CONDUITS

.1 Conduit in ordinary areas and humid corrosive environments shall be Rigid PVC. Minimum size to be 19 mm.

.2 Conduit in hazardous areas shall be threaded rigid aluminum epoxy coated conduit with zinc coating and corrosion resistant epoxy finish inside and outside. Minimum size to be 19 mm.

.3 Liquid-tight flexible metal conduit for motor and equipment connections.

.4 EMT conduit shall not be utilized anywhere in the installation.

2.2 CONDUIT FASTENINGS

.1 One-hole steel straps to secure surface conduits 50 mm and smaller. Two-hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90^{o} bends are required for 25 mm and larger conduits.

2.4 EXPANSION FITTINGS FOR CONDUIT

.1 All conduits entering outlet boxes and devices that are in walls subject to movement shall be terminated by means of liquid-tight flexible conduit, approximately 450 mm in length between the conduit and the outlet box or device which is being supplied. All conduits, bus duct, wireways, etc., passing through or across expansion joints of the building shall be installed with the use of approved expansion fittings.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Use rigid pvc conduit unless otherwise noted.

.4 Use rigid pvc conduit underground and in cast concrete.

.5 Use flexible metal conduit for connection to motors.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Minimum conduit size: 19 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 19 mm dia.

.10 Install fish cord in empty conduits.

.11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.12 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as permitted by the Contract Administrator

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to building to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Cable tray to form a complete system, including straight lengths, horizontal and vertical elbows, tees, crosses, reducers, couplers, covers and accessories as detailed in this specification an as shown on drawings.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals and Section 260501 – Common Work Results for Electrical.

Part 2 Products

2.1 TRAY

.1 Ladder type, Class D1 to CSA C22.2 No. 126.

.2 Extruded aluminum tray.

.3 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required. Fittings: manufactured accessories for cable tray supplied.

.4 Solid covers for cable tray system located below 2000mmm above finished floor, under platform grating, and outdoors.

.5 Barriers where different voltage systems are in the same cable tray.

.6 Cable tray width as indicated with a minimum cable loading depth of 100 mm.

2.2 SUPPORTS

.1 Provide supports, hangers, and securing devices as required for complete installation.

2.3 ACCEPTABLE MANUFACTURERS

.1 Electro-Tray.

.2 Canstrut Products

.3 Cooper B-Line

.4 Unitray Systems Inc.

.5 Unless otherwise approved by the Engineer, provide cable trays of the same manufacturer throughout the contract.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable tray system.

.2 Support cable tray as shown on drawings and as recommended by manufacturer.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 Coordinate supports and tray location with work of other trades. Notify Engineer of any conflicts and obtain a ruling before proceeding with the installation. Prepare roughing-in drawings illustrating the locations and methods of supports of all components.

.5 Where terminations are indicated, provide a grommet or protective bushing to protect exiting cables.

.6 Provide cable tray covers on all trays at floor level and up to 2000 mm above floor level or finished grade, under platforms, and outdoors.

.7 Ground cable tray as required in section 260528.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 3 m centers, with nylon ties.

.4 Where cable trays are mounted vertically on wall, secure cables at 1.5 m intervals with P type clamp fasteners.

.5 Control and instrument cables shall be random fill with a barrier separation between power cables.

.6 Selected feeder cables shall have an air gap between them equal to 100% of the largest cable diameter. Refer to cable schedule for details.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 Refer to Section 26 05 01 Common Work Results for Electrical.

.2 Furnish all labour, materials, equipment, and services specified, indicated, or requested to install the trenches and underground conduits as specified herein and on the drawings.

1.2 SCOPE

.1 Furnish all labour, materials, supervision, equipment, and services specified, indicated of requested to provide all trenching and backfilling as necessary for the installation of all underground conduits and cables, as indicated.

.2 Direct buried cables are not expected to be required on this project and shall only be installed with approval by the Engineer.

1.3 QUALITY ASSURANCE

.1 Installation of cables in trenches and ducts shall meet the requirements of the latest edition of CSA C22.1 – Canadian Electrical Code.

Part 2 Products

2.1 TRENCHING AND BACKFILLING

.1 Trenching shall be approximately 1000 mm in depth, width to suit proper installation.

.2 Backfill for trenches for all ducts, conduits, and cables shall consist of fine sand (minimum 100 mm below and above cables, etc.) and firmly compacted

.3 All ducts, and conduits crossing over each other or over/under other types of underground service shall be separated by minimum of 150mm and surrounded by wood planks treated with pentachlorophenol.

.4 Frozen earth, large lumps or boulders shall not be used for backfilling material.

.5 Where direct buried cables are approved by the Engineer provide treated wood planks over all such cables installed under existing or future roads and sidewalks, and provide sleeves under all parking, concrete and traffic areas for cables.

2.2 CABLE PROTECTION

.1 Provide identification tape labeled as indicated showing location of direct buried cables.

Part 3 Execution

3.1 INSTALLATION OF UNDERGROUND CONDUITS AND DIRECT BURIED CABLES

.1 After specified sand bed is in place, lay conduits, or cables in trench, maintaining a 75 mm minimum clearance from each side of trench to nearest conduit or cable. Do not pull cable into trench.

.2 For cables, provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 M run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices are not acceptable

.4 Minimum permitted radius of conduits is 300mm. Cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

3.2 CABLE INSTALLATION IN CONDUITS

.1 Install cables and wiring as indicated in underground conduits.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in underground conduit simultaneously.

.3 Use CSA approved lubricants as specified as part of the cable manufactures cable pull design to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 After installation of cables and wiring, seal duct ends with duct sealing compound.

.6 Seal all spare conduits at entry to buildings using permanent pressure resistant long-term plugs. Plugs must be constructed with rubber gaskets that can be compressed to form a permanent seal of the conduit.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits, and grounds. Ensure resistance to ground of circuit is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before terminating, perform insulation resistance test with 1000V megger on each phase conductor

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

.8 Contractor responsible for making all necessary repairs to installation resulting from improper backfilling, compactions, etc.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This section of the specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Provide seismic restraint and anchorage for all equipment and services in accordance with the current edition of the BC Building Code except that the seismic loads shall be determined in accordance with the current edition of the National Building Code of Canada.

.3 The total electrical seismic restraint design and field review and inspection will be by an EGBC-registered professional structural engineer who specializes in the restraint of building elements. Contractor shall allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.4 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.

.5 The Contractor’s Seismic Consultant shall submit original signed BC Building Code “Letters of Assurance”, “Schedules B1, B2, and C-B” to the Prime Contractor or Electrical Consultant.

1.2 REFERENCE STANDARDS

.1 Conform to the following reference standards (editions as enforced in the Province of Alberta at time of facility construction):

.1 BC Building Code.

.2 National Building Code of Canada.

1.3 SUBMITTALS

.1 Shop Drawings: Submit with the related items of equipment in accordance with Section 01 33 00 and Section 26 05 01.

.2 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic consultant.

.3 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

Part 2 Products

2.1 GENERAL

.1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

.2 Provide restraint on all equipment and machinery, which is part of the facility electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.3 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.

.4 Provide seismic restraints on all equipment, and/or installations, or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

Part 3 Execution

3.1 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, e.g. transformers, switchgear, motor control centres, free standing panel boards, control panels, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity as instructed by the Seismic Consultant.

3.2 CONDUITS AND CABLE TRAY

.1 Provide restraint installation information and details on conduit and equipment as indicated below:

.1 Vertical Conduit:

.2 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.3 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide

lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m.

.4 Riser joints shall be braced or stabilized between floors.

.2 Horizontal Conduits:

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.2 Metal conduits shall be supported at approximately 1.2 m intervals for this metal tubing.

.3 Provide transverse bracing for cable trays and conduit racks at 12.2 m o.c. maximum unless otherwise noted. Provide bracing at all 90^{o} bend assemblies and pull box locations.

.4 Provide longitudinal bracing for cable tray and conduit racks at 24.4 m o.c. maximum unless otherwise noted.

.5 Do not brace cable trays stacks or conduit rack runs against each other. Use separate support and restraint system.

.6 Support all cable trays and conduit racks in accordance with the capability of the selected material to resist seismic load requirements indicated or as instructed by the Seismic Consultant.

.7 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.8 A tray system (tray stack) or conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake event. Examples: wall and a roof; solid concrete wall and a metal deck.

.9 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with fire-stopping where required.

.10 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with Seismic Consultant and submit shop drawings to consultants for their reference.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 Refer to all other Sections of the Specifications and these Documents to determine their effect upon the work of this Section.

.2 In case of a conflict with another specification, use the more stringent of the two standards. In addition, contact the Engineer for further clarifications.

1.2 INTENT

.1 The Contractor shall provide testing and commissioning of the electrical and control systems for the facility. The testing and commissioning process will be used to bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.

.2 The testing and commissioning process for the work consists of:

Stage 1: Contractor Supplied Verification Forms

Stage 2: Component and Equipment Verification & Testing.

Level 1: Equipment Verification

Level 2: Point Verification

Stage 3: Starting and Testing of Subsystems.

Stage 4: Facility Startup testing and fine tuning

Level 1: System Verification

Level 2: Integrated Systems Verification.

.3 Defined in this Section are the Contractor's and Engineer's responsibilities relating to the coordination and implementation of the commissioning process.

Part 2 Products

NOT APPLICABLE

Part 3 Execution

3.1 GENERAL

.1 The process to be utilized for this project consists of EQUIIPMENT, SYSTEM, and INTEGRATED SYSTEMS verification tests to be documented on Contractor developed verification forms. Submit forms for Engineers review.

.2 Prior to starting and testing of equipment or subsystems, prepare a schedule for the required testing. Review with Engineer.

.3 Schedule Facility Startup tests with the Engineer to minimize impact on processes or systems.

.4 Arrange for manufacturers to submit copies of all factory test records prior to commissioning.

.5 Have all verification sheets and testing sequences approved by the Engineer prior to starting.

.6 The Contractor shall conduct testing in conjunction with the Engineer. Contractor will ensure all the necessary subcontractors are available to correct any problems during testing. The Engineer may witness all any portion of testing, commissioning, and starting procedures performed by the Contractor.

.7 Provide two-way radios, ladders and other equipment as required to complete the commissioning as outlined.

.8 Contractor's personnel shall be equipped with Contractor provided tools and equipment necessary for the testing and commissioning. This will include but not be limited to:

- .1 Multimeter
- .2 AC Current Meter
- .3 Loop Current Generator

.9 Obtain certificates of approval, acceptance and comply with rules and regulation of authorities having jurisdiction. Provide copies of certificates to Engineer.

.10 Submit completed verification forms immediately after tests are performed.

- .1 Record all data on site on approved verification forms.
- .2 Provide Engineer with the original record of each completed verification form, make any necessary corrections and resubmit as requested by Engineer.
- .3 Maintain one completed copy on site during starting and testing period.
- .4 Maintain one copy of all final starting, testing balancing and adjusting reports on site up to substantial performance of the work for reference purposes.

.5 All final verification forms are to be typewritten.

.11 Thoroughly overhaul and restore to new condition all equipment that has been operated by contractor during construction phase.

.12 Permanently mark all settings in such a manner that they cannot be eradicated or obliterated in any way.

.13 Record all final settings on record drawings.

3.2 STAGE 1: CONTRACTOR SUPPLIED VERIFICATION FORMS

.1 Verification forms generated by the Contractor will supplement any factory provided test data.

.2 Component Verification forms shall be provided for each piece of equipment, after receipt of approved shop drawings, and forwarded to the Engineer for review, revisions, and finalization.

3.3 STAGE 2 – COMPONENT/EQUIPMENT VERIFICATION AND TESTING

.1 Level 1 – Equipment Verification Forms:

.1 The Contractor is responsible for performing all tests and measurements and recording results on the component verification forms.

.2 Where additional verification forms are required, the Contractor shall develop appropriate forms and submit them to Engineer for review prior to use.

.2 Level 2 – Point Verifications:

.1 The Contractor shall prove all wiring and loops between the various components.

.2 Confirmation that the loop test has been completed shall be recorded on the verification forms.

3.4 STAGE 3: SUBSYSTEM VERIFICATIONS:

.1 All Subsystem verification and testing is to be executed by the Contractor.

.2 All related components verification must be completed and approved prior to executing subsystem verifications.

.3 Subsystem verifications will be detailed on verification forms provided by the Contractor, unless otherwise instructed by the Engineer.

.4 The Verification tests are intended to prove the integrity of the hardware and software for each individual subsystem. Tests to include (but not limited to) the following:

.1 Operation of system in “Remote” and/or “Auto” mode (PLC).

.2 Operation of system in “Local” and/or “Hand” mode (Operator Initiated).

.3 Emergency Manual Mode (PLC Failed).

.4 Safe shutdown in response to a power failure.

.5 Quality and quantity of desired product.

3.5 STAGE 4: FACILITY STARTUP TESTING AND FINE TUNING

.1 For new water mains and specific treatment processes the Engineers guidelines for acceptance testing must be followed as provided in the specification package.

.2 Prior to Facility Startup testing the Contractor must have the following documentation complete and on hand during the testing:

.1 All test reports (Manufacturers, as well as equipment, per respective division, and subsystems).

.2 Shop Drawings and Product Data.

.3 The Contract Documents and any Contractor marked up redline (as-built) drawings developed during construction.

.3 Responsibilities:

.1 Engineer will do the following during System and Integrated Systems Testing and fine-tuning.

.1 Assist in the coordination of the preplanned integrated system performance tests under conditions simulating, the extent possible, full, and partial operating loads and emergency load conditions.

.2 Review Contractor documentation of test results.

.3 Diagnose problems and determine whether they are the result of Contract Deficiencies.

.4 Request repeat tests as required following correction of Contract Deficiencies and execution of Change Orders by Contractor and verify results.

.5 Provide direction and instruct in the fine-tuning of the systems under test to satisfy the operating requirements.

.2 Contractor will do the following during System and Integrated Systems Testing and fine-tuning.

.1 Conduct Integrated System testing and document results.

.2 Modify operating parameters of the systems to satisfy the fine turning requirements outlined by the Engineer, to ensure proper system operation. For Example:

.1 Make adjustments that may become apparent as testing proceeds.

.2 Modifications to suit changes as equipment settles down during the “running in” period.

.3 Documentation of results.

.4 Diagnosis of problems.

.5 Correct Contract Deficiencies previously outstanding and those identified during Integrated Systems verification and fine-tuning.

.6 Execute Change Orders issued by the Engineer.

.3 Fine-tuning will provide for the adjustment of the systems and integrated systems testing have shown a need.

.4 Start-Up Progress Meetings:

.1 Start-up meetings will be held prior to each SYSTEMS and INTEGRATED SYSTEMS tests.

.2 The Contractor is to put forward the agenda, chair the meeting as well as record and distribute the minutes.

.3 Meetings will introduce, monitor progress, and resolve any issues or deficiencies relating to the Startup Process.

.4 Based on the requirements of the agenda the attendees shall include but not be limited to:

.1 Contractor's representatives: Contractor's site superintendent, mechanical and electrical subcontractors, controls subcontractor and when so requested by the Engineer: suppliers, inspection and testing companies and their parties involved in the Work. Contractor's representatives shall be qualified and authorized to act on behalf of the party each represents.

.2 Owner's representatives: Project Managers, Consulting Engineers, Operations and Maintenance representatives as required.

.5 Provide sufficient notice (minimum 72 hours) prior to commencing tests.

.6 Coordinate all sub-trades, other divisions, manufacturers, suppliers, and other specialists as required to ensure all phases of work shall be properly organized prior to commencement of each testing procedure. Establish all necessary staffing requirements.

.7 Coordinate starting of mechanical equipment and systems with testing and demonstration and instruction of:

.1 Electrical equipment and systems as specified.

.2 Mechanical equipment and systems as specified.

.3 Other equipment and systems as specified.

3.6 LEVEL 1: SYSTEM VERIFICATIONS

.1 System tests will verify proper operation of each system individually, including operation of ancillary subsystems.

.2 All related component and subsystem verifications must be completed and approved prior to the execution of the system verifications.

.3 To ensure system operations conform with the contract documents:

.1 Each system is operated for as long as required to commission the project and to verify performance.

.2 Results of testing and procedures are checked and verified to be correct within stated tolerances. If inconsistencies appear between reported results and demonstrated values, the relevant testing procedures are repeated, and adjustments made until satisfactory results are obtained.

3.7 LEVEL 2: INTEGRATED SYSTEM VERIFICATIONS

.1 The Intent of these tests is to prove proper operation of the completed facility operating as an integrated system.

.2 All related component, subsystem and systems verifications must be completed and approved prior to the execution of the integrated system verifications.

.3 Tests shall include:

.1 Behavior during plant power failure.

.2 Behavior during PLC failure.

.3 Failure of critical components in worst case scenarios.

.4 System interlocks.

.5 Operation in Auto, Manual, and Emergency Manual modes.

.4 To ensure operation conforms to the contract documents:

.1 Verify performance of system operating in conjunction with one another under all conditions and modes of operation. Each system is operated for as long as required to commission the project and to verify performance.

.2 Results of testing and procedures are checked and verified to be correct within stated tolerances. If inconsistencies appear between reported results and demonstrated values, the relevant testing procedures are repeated, and adjustments made until satisfactory results are obtained.

3.8 COMPLIANCE WITH DEFINED PROCEDURES:

.1 Failure to follow the specific instructions defined herein pertaining to correct starting procedures may result in re-evaluation of equipment by independent testing agency selected by Engineer at the Contractor’s expense. Should results reveal that equipment has not been started in accordance with specified requirements, equipment may be rejected. If rejected, remove equipment from site and replace. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.

.2 Performance testing of any system by Engineer does not reduce the Contractor's obligations for complete testing and start-up systems as specified.

END OF SECTION

Part 1 GENERAL

1.1 GENERAL CONDITIONS

.1 Refer to all other Sections of the Specifications and these Documents to determine their effect upon the work of this Section.

.2 In case of a conflict with another specification, use the more stringent of the two standards. In addition, contact the Engineer for further clarifications.

1.1 INTENT

.1 Provide demonstration and instruction sessions to familiarize the Owner's operation and maintenance personnel with electrical systems and their operation and maintenance.

1.2 MANUFACTURER'S SITE SERVICES

.1 Arrange and pay for appropriately qualified manufacturer's representatives to provide or assist in providing electrical equipment and systems demonstration and instruction as specified herein.

1.3 CONTRACTOR

.1 The Engineer will chair demonstration and instruction sessions.

.2 Establish agendas for demonstration and instruction sessions in conjunction with the Engineer. Coordinate scheduling of sessions with the Engineer and the Owner.

1.4 DEMONSTRATION AND INSTRUCTION SEMINARS

.1 Prepare a schedule identifying the proposed sequence of demonstration. Sequence of demonstration shall correspond to full system starting.

.2 Include a description of each system, and each piece of equipment.

.3 Instruct the Owner and his maintenance staff on operation and maintenance procedures of all major electrical systems. This instruction shall be performed twice, once when systems are being energized and tested and once before building is turned over to the Owner.

.4 Answer all questions raised by Engineer at demonstrations. If unable to satisfactorily answer questions immediately, provide written response within three days.

Part 2 PRODUCTS

NOT APPLICABLE

Part 3 EXECUTION

3.1 SYSTEMS DEMONSTRATIONS

.1 Centrifuge:

.1 Normal Operation, in auto and in manual.
.2 Meeting performance of system.
.3 Power outage and resume.
.4 Fault of primary system.
.5 Fault of downstream system (and response) ie. Conveyor(s); and
.6 Adjustment of polymer system through Centrifuge.

.2 Conveyors:

.1 Normal Operation, in auto and in manual.
.2 Meeting performance of system.
.3 Power outage and resume.
.4 Fault of primary system; and
.5 Fault of downstream system (and response) (1,2, but not 3).

.3 Polymer:

.1 Normal Operation, in auto and in manual.
.2 Meeting performance of system.
.3 Power outage and resume.
.4 Fault of primary system; and
.5 Fault of downstream system (and response) (centrifuge/conveyors).

.4 Variable Frequency Drives:

.1 Selecting and reading information from operator interface.
.2 Local – Remote operation of the VFD.
.3 Reading and interpreting VFD error codes.
.4 Basic troubleshooting methods to assist service representative in assessing problem over phone prior to coming to site.

.5 Motor Control Center:

.1 Instruct operators on locking out 600 Volt power circuits.
.2 Local and Remote operation of motor starters.

.3 Manual and Auto operation of transfer switch, timer settings and adjustments.

.6 Control Panel

.1 Location of fuses and circuit breakers for various instrument

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results for Electrical.

.2 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 All equipment to latest edition of CSA Standard C22.2 No. 29.

.2 Fault current ratings to be indicated on nameplates.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

.2 Include panelboard literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 120/208 V, 3Ø, 4-wire panel boards: Bus and breakers rated for minimum 10 kA (symmetrical) interrupting capacity unless noted otherwise.

.3 347/600 V, 3Ø, 4-wire panel boards: Bus and breakers rated for minimum 35 kA (symmetrical) interrupting capacity unless noted otherwise.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.

.7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.

.8 Panelboards to have flush doors. (Gasketted where required).

.9 Two keys for each panelboard and key panelboards alike.

.10 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.

.11 Copper bus with neutral of same ampere rating as mains.

.12 Mains: suitable for bolt-on breakers.

.13 Trim with concealed front bolts and hinges.

.14 Trim and door finish: baked grey enamel.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 All breakers to be bolt on type, moulded case, nonadjustable and non interchangeable trip, single, two and three pole, 120/208V or 347/600V and with trip free position separate from "On" or "Off" positions.

.3 Two and three pole breakers to have common simultaneous trip and able to be in any circuit position within the panelboard.

.4 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.5 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.

.6 Provide at least 10% spare 15 Amp single pole breakers whether indicated or not.

.7 Provide GFI type breakers as indicated.

.8 Provide Lock-on devices as indicated on the drawings, and in any event for Fire Alarm circuits, Security equipment circuits, EXIT sign circuits and Emergency Battery equipment circuits.

.9 NEMA 4X enclosure in process environments, NEMA 12 enclosure in ordinary areas.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

.5 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a “letter sized” paper copy of each directory in the project maintenance manual.

.6 Provide a plasticized typewritten information card fixed to the back of each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pull boxes. Include a “letter sized” paper copy of each information card in the project maintenance manual.

2.4 MANUFACTURER

.1 Schneider, Eaton, or Owner Approved Equal.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true, and square, to adjoining surfaces.

.2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section describes the modification of Motor Control Centres (MCCs) for the Project.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results for Electrical.

.2 Section 26 28 21 – Moulded Case Circuit Breakers.

.3 Section 26 29 10 - Motor Starters.

.4 Section 26 29 11 - Variable Frequency Drives.

.5 Section 26 36 23 - Automatic Transfer Switches.

.6 Section 26 43 13 – Surge Protection Devices.

.7 Installation of anchor devices, channel base sills, setting templates in accordance with Section 03 30 00 - Cast-in-Place Concrete.

1.3 QUALITY ASSURANCE

.1 Conduct equipment inspection at manufacturer's plant.

.2 Provide manufacturer's type test certificates.

.3 The Engineer reserves the right to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters, and controls.

.4 Submit written test results to the Engineer.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals. Indicate:

.1 Outline dimensions.
.2 Configuration of identified compartments.
.3 Floor anchoring method and dimensioned foundation template.
.4 Cable entry and exit locations.
.5 Dimensioned position and size of busbars and details of provision for future extension.
.6 Schematic and wiring diagrams.
.7 Configuration of the MCC internal communication and main components.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for motor control centre for incorporation into the Operation and Maintenance Manual as specified in Section 26 05 01.

.2 Include data for each type and style of starter.

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 05 01.

.2 Provide listed spare parts for each different size and type of starter:

.1 2 sets of contacts, stationary
.2 2 sets of contacts, movable
.3 1 set of contact, auxiliary
.4 1 control transformer for each VA rating
.5 1 operating coil for each starter size supplied
.6 2 fuses of each rating
.7 4 indicating lamps for each type provided
.8 2 relays for each type provided

1.7 CODES AND STANDARDS

.1 Materials and workmanship shall comply with codes and standards of the Province in which the work is located and local codes, regulation, and standards.

.2 In addition, the work shall conform to the latest editions and amendments of the applicable Codes and Standards of the following agencies:

.1 EEMAC Standard ICS2-322.
.2 CSA Standard C22.2 No. 14, "Industrial Control Equipment".
.3 CSA Standard C22.1, Canadian Electrical Code, Part I plus Provincial supplements.
.4 Applicable sections of ANSI (American National Standards Institute) Standards.
.5 All equipment to be CSA approved.

1.8 GUARANTEE

.1 The performance of the motor control centre equipment shall be guaranteed throughout to perform the duty stated herein in accordance with General Conditions.

Part 2 Products

2.1 APPROVED MANUFACTURERS

.1 Manufactured breakers to match Allen Bradley 2100 Series MCC (Serial: 2100-M5041906/02 Series M, 600A Horizontal, 300A Vertical, 12 sections).

2.2 SUPPLY CHARACTERISTICS

.1 MCC to meet existing rating and certification.

2.3 MOTOR CONTROL CENTRES GENERAL DESCRIPTION

.1 The MCC shall be service entrance rated and provide motor control in the form of breakers, FVNR starters, Variable Frequency Drive (VFD) controllers, and provisions for spares as indicated on the drawings. The MCC shall also provide a BC Hydro approved incoming wire way, BC Hydro approved compartment for utility metering CT/ PTs, customer information metering, and surge protection device.

.2 The MCC enclosure shall be rated NEMA Type 1A, complete with gasketted doors. Vertical sections shall be constructed with steel divider sheet assemblies formed or otherwise fabricated to eliminate open framework between adjacent sections.

.3 Structures shall be totally enclosed dead-front, free-standing assemblies for floor mounting. Structures shall contain horizontal wireways at the top and bottom, isolated from the horizontal bus via metal barriers and shall be readily accessible through a removable cover. Ability for both top and bottom cable entry shall be provided.

.4 Fish tape barriers shall be provided in the vertical structure and unit designs to prevent the contact of any energized bus and/or terminal by a fish tape, inserted/pulled through a conduit or wireway, and/or by cables routed through the bottom (and top) of the MCC.

.5 Ensure main incoming circuit breaker or incoming lug compartments are complete with barriers from the busses.

.6 Compartmentalized vertical sections with common power busbars.

.7 Accommodating incoming cable to enter at bottom of the utility approved service entrance wire way section, and feeder cabling to enter/exit top and bottom.

.8 Wiring to NEMA Class II, Type B.

.9 Main incoming circuit breaker shall be complete with solid state LSIG electronic trip unit. Main incoming circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time and instantaneous tripping for phase to ground fault short circuit protection.

.10 Main and feeder circuit breakers, as per Section 26 28 21 - Circuit Breakers.

.11 Automatic Transfer Switch, as per Section 26 36 23 – Automatic Transfer Switches.

.12 Motor circuit protector combination starters, as per Section 26 29 10 - Motor Starters.

.13 Variable frequency drive (VFD) controllers, as per Section 26 29 11 - Variable Frequency Drives.

.14 Provide a surge protection device (SPD) in the MCC, as per Section 26 43 13 – Surge Protection Devices.

.15 Independent vertical sections fabricated from rolled flat steel sheets, bolted together to form rigid, completely enclosed assembly.

.16 Each vertical section divided into compartment units; minimum 150 mm high.

.17 Each unit to have complete top and bottom steel plate for isolation between units.

.18 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.19 Vertical wireways for load and control conductors extending full height of vertical sections and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.20 Openings, with removable cover plates, inside of vertical sections for horizontal wiring between sections.

.21 Provision for outgoing cables to exit via top and bottom.

.22 Removable lift means.

.23 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

.24 All control and interposing relays required for motor starters and VFDs shall have coils rated at 120V or 24V as shown on the drawings, and each complete with surge suppressors to protect sensitive equipment from voltage spikes.

2.4 SILLS

.1 Continuous 100 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Each structure shall contain a main horizontal tin-plated copper bus, with minimum ampacity of 600 amperes or as shown on the drawings. The horizontal bus shall be rated at 65^0 C temperature rise over a 40^0 C ambient in compliance with ULC standards. Vertical bus feeding unit compartments shall be tin-plated copper and shall be securely bolted to the horizontal main bus. All joints shall be front-accessible for ease of maintenance. The vertical bus shall have a minimum rating of 300 amperes. Both vertical and horizontal bus shall be fully rated; but shall not be tapered. Vertical bus shall not be reduced rated via centre feeding, and be fully rated, top and bottom, from centreline bus.

.2 The vertical bus shall be completely isolated and insulated by means of a labyrinth design barrier. It shall effectively isolate the vertical buses to prevent any fault-generated gases from passing from one phase to another. The vertical bus shall include a shutter mechanism that will allow the unit stabs to engage the vertical bus every 150 mm and provide complete isolation of the vertical bus when a unit is removed.

.3 The vertical bus barrier support shall be designed as to effectively enclose each vertical bus bar. Provisions shall be made to close off unused unit stab openings in the vertical bus barrier with removable covers.

.4 All buses shall be braced for minimum of 42,000 amperes RMS, symmetrical.

.5 A tin-plated horizontal copper ground bus shall be furnished, securely attached to each vertical section structure, and shall extend the entire length of the Motor Control Centre. Ground bus shall be in the bottom horizontal wireway.

.6 Each structure shall contain tin-plated vertical ground bus rated 300 amperes. The vertical ground bus shall be directly connected to the horizontal ground bus via a tin-plated copper connector. Units shall connect to the vertical bus via a tin-plated copper stab.

.7 The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack is installed into the end of the MCC power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts must not be required when splicing higher amperage bus. The splice bolts shall secure to self-clenching nuts installed in the bus assembly.

.8 No other cables, wires, equipment in main and branch busbar compartments.

.9 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 STARTER UNIT COMPARTMENTS

.1 Units NEMA size 4 and smaller, circuit breaker units 225 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make

positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free-floating silver-plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front as indicated.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 All starters and contactors to have two N.O. and two N.C. spare contacts wired to terminal blocks.

2.7 MCC METERING

.1 Provide MCC with a microprocessor based self-contained, door-mounted device designed to monitor and display 3 phase AC current and voltage. The device shall monitor the following electrical parameters as a minimum:

.1 AC line current (each phase). (1% accuracy)

.2 AC line to line voltage (all three). (1% accuracy)

.3 Watts. (2% accuracy)

.4 Vars. (2% accuracy)

.5 Power Factor. (4% accuracy)

.6 Watt demand. (2% accuracy)

.7 Frequency. (1.5% accuracy)

.8 Watt-hours. (2% accuracy)

.9 Line - N Volts (1% accuracy)

.10 Harmonics analysis/display and % Total Harmonic Distortion

.2 The device shall be complete with a minimum of two (2) Form ‘C’ relay outputs for alarming to the station PLC control panel. Alarms available:

.1 over voltage.

.2 under voltage.

.3 voltage phase loss.

.4 current phase loss.

.5 line voltage unbalance.

.6 voltage phase reversal.

.3 Each function shall have the ability to perform a time-delayed or instantaneous trip/alarm through relays with Form C contacts.

.4 Provide three relay accuracy current transformers to provide 5 Amp current signals to the meter.

.5 The meter shall be mounted on MCC cabinet door and shall have LED display and programming keypad.

.6 The meter shall have Ethernet/IP communication capabilities.

2.8 WIRING AND TERMINAL BLOCKS

.1 The shop installed wiring arrangement shall be as indicated. For Type B wiring, all control connections to be brought to terminal blocks within each starter compartment. Provide a minimum of 4 spare terminal blocks for #12 AWG incoming control wiring.

.2 Provide internal power wiring from the line side of each starter to the bus stabs with a minimum of #12 AWG wire rated for 600 Volt duty. Size wiring to accommodate the largest horsepower that the line starter is capable of switching.

.3 Control wiring shall be rated 600 Volt, XLPE insulated, minimum #14 AWG size. Install wiring to panel doors utilizing extra flexible 49-strand conductors.

.4 All internal wiring shall employ stranded copper conductors.

.5 Identify all wiring by means of heat shrink type wire markers as manufactured by Critchley fixed to each conductor at both ends.

.6 Wires shall be colour coded as follows:

.1 Control circuits – Red

.2 Power circuits – Black

.7 Terminal blocks shall be of the compression type and shall be of modular pull-apart construction enabling unit wiring to be easily separated from the field wiring. Identify all terminal blocks with numbers identical to the wire numbers.

.8 No more than two wires shall be placed under each terminal screw.

2.9 INCOMING LINE TERMINATION

.1 Provide pressure type cable lugs and bus adapters or extensions suitable for terminating the main incoming cable conductors. The lugs shall accommodate

the number and size of cables as provided by BC Hydro. Cable entry shall be from the bottom of the MCC.

2.10 SPACE FOR FUTURE UNITS

.1 Provide fully equipped spaces with horizontal and vertical bus bars and all fittings necessary to accommodate future equipment with a minimum of field alterations and additions. Provide bolted-on blank covers.

2.11 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 01.

2.12 EQUIPMENT IDENTIFICATION

.1 Provide motor control centre main nameplate and individual compartment nameplates identification engraved in accordance with Section 26 05 01.

2.13 FINISHES

.1 Apply finishes in accordance with Section 26 05 01 - Common Work Results for Electrical:

.1 Exterior: Grey, ASA61.

.2 Internal: White, one (1) coat of primer and two (2) coats of finish, 1.5 mils per coat for a total thickness of 3 mils.

.2 Supply two (2) cans of touch-up paint.

2.14 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Engineer retains the option to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters, and controls.

.3 Manufacturer to provide proof of quality control program in accordance with CAN/CSA Q9000.

Part 3 Execution

3.1 SHOP ASSEMBLY

.1 Shop assembly shall be maximized, to minimize the on-site erection work. Equipment should thus be shipped in as few subassemblies as is practical and in accordance with overall erection schedule.

.2 Containers and components clearly identified for transportation and field assembly.

3.2 PACKAGING AND SHIPPING.

.1 Each item shall be packed, crated, or otherwise protected so that it is not damaged in transit and arrives in serviceable condition at the site. Measures shall be taken to prevent accumulation of water in equipment.

.2 Crates, boxes, and cartons shall be clearly marked to indicate the purchase order number and the name of the equipment.

.3 Shipping invoice shall show the crate, box, or carton number.

.4 All finished rubbing surfaces which are not assembled in the shop shall be adequately protected during shipment by wrapping with burlap or canvas or other means which shall be secured by wooden batts securely wired together.

.5 Shipping: Include the cost of loading, transportation, and off-loading.

3.3 INSTALLATION AND TESTING

.1 Install embedded floor channels where applicable.

.2 Set and secure MCC's in place, rigid, plumb, and square, on channel bases.

.3 Interconnect MCC cubicles with bus bar and wiring connectors supplied by manufacturer.

.4 Check factory-made connections for mechanical security, electrical continuity, and current phasing.

.5 Make grounding connections between equipment ground busses and building grounding system.

.6 After finishing work, remove foreign material, including dust, before energizing equipment.

.7 Perform all tests in accordance with Section 26 05 01.

.8 Make all power and control field wiring connections.

.9 Check overload trip unit settings against drawings and motor nameplate data.

.10 Ensure moving and working parts are lubricated where required.

.11 Ensure full functionality of the Ethernet I/P communication to plant PLC for remote control, status, and alarms.

.12 Operate starters in sequence to provide satisfactory performance of motor control centre during commissioning period.

3.4 COMMISSIONING

.1 The Contractor shall include for the testing and commissioning of the complete systems.

.2 The Contractor shall include and provide for the services of the motor control centre manufacturer representative(s) to inspect and approve installation, participate in testing and commissioning, and instruct the Owner's personnel in the operation of the systems.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, latest edition).

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submissions.

.2 Include wiring devices literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

Part 2 Products

2.1 MANUFACTURER

.1 Wiring devices shall be of one manufacturer throughout the project.

.2 Acceptable Manufacturers: Hubbell, Bryant, or Pass & Seymour.

2.2 DEVICES

.1 The catalogue numbers shown below are for the manufacturer’s series and all necessary suffixes shall be added for the requirements as stated. For all devices, use the specification grade minimum.

2.3 SWITCHES

.1 Extra heavy-duty specification grade.

.2 20 A, 120 V, single pole, double pole, three-way, four-way switches as indicated.

.3 Manually-operated general purpose ac switches as indicated and with following features:

.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine moulding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 White toggle (red toggle for emergency power circuits).

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.5 Standard of acceptance:

.1 Hubbell HBL.1221 20A series.
.2 Leviton 1221-20A 120V series.
.3 Pass & Seymour PS20AC1 120V series.

2.4 RECEPTACLES - GENERAL

.1 Extra heavy-duty specification grade.

.2 Duplex receptacles, NEMA 5-20R, 125 V, 20 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 White nylon molded housing (red for emergency power circuits).
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and riveted grounding contacts.
.6 Dual 15/20A configuration.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Standard of acceptance:

.1 Hubbell 5362 heavy duty, construction series.
.2 Leviton 5362 series.
.3 Pass & Seymour 5362 series.
.4 Or as indicated on drawings.

2.5 RECEPTACLES – PARTICULAR APPLICATION

.1 Ground Fault Interrupter type: 15 Amp or 20 Amp as indicated, 125 V, duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U

ground, impact resistant nylon face, complete with breaker and reset button. Equal to:

.1 Hubbell GFR-5262TR (15A) and GFR-5263TR (20A) series.

.2 Leviton or Pass & Seymour equivalent.

.2 All other single outlet and special purpose receptacles to be like the grade and series indicated above. Confirm ampacity, voltage, and pin configuration prior to installation.

2.6 COVER PLATES

.1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. For general interior flush mounted wiring devices and surface type FS or FD type boxes. Cover plates from one manufacturer throughout project.

.2 Nylon plates: Heavy duty, unbreakable and flush. All nylon plates to match wiring device color.

.3 Steel: sheet steel hot dip galvanized with rolled edges for surface mounted utility boxes.

.4 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.

.5 All plates to be bevelled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.

.6 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.

.7 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Cover plates to fasten to box by four screws.

.8 Gaskets: resilient rubber or close cell foam urethane.

.9 Cover plates for all wiring devices to be from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION

.1 Provide identification label on switch cover plate complete with circuit number.

.2 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results for Electrical.

.3 Receptacles:

.1 Provide identification label on receptacle cover plate complete with circuit number.

.2 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.3 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.

.4 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results for Electrical.

.4 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 24 19 – Motor Control Centre.

.2 Section 26 24 17 – Panelboards Breaker Type.

1.2 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.2 ANSI C37.13, C37.16, C37.17, C37.50.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with 01 33 00 - Submittals.

.1 Include time-current characteristic curves for breakers.

.2 Include circuit breaker literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

1.4 COORDINATION

.1 Breakers with adjustable trip units must be set as per the settings included in the protective device coordination study supplied and completed by the Contractor and reviewed by the Engineer.

Part 2 Products

2.1 MOULDED CASE CIRCUIT BREAKERS (GENERAL)

.1 Bolt-on moulded case circuit breaker to CSA C22.2 No.5: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position.

.3 Common-trip: with through-the-door single handle mechanism for multi-pole applications.

.4 Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings. Breakers shall be fully-rated; series-rated interrupting ratings will not be accepted.

.5 MCC main incoming circuit breaker shall be complete with solid state LSIG electronic trip unit and to operate by means of the solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, and instantaneous tripping for phase to ground fault short circuit protection.

.6 MCC feeder circuit breakers are to be assembled in draw-out unit wrappers.

.7 Thermal magnetic moulded case feeder circuit breakers up to 250 Amp are to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.8 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Instantaneous trip settings on breakers with adjustable trips to range from 3 - 10 times current rating.

.9 Circuit breakers with interchangeable trips as indicated.

.10 Ground fault interrupter breakers for circuits feeding heat tracing cables and as otherwise indicated on drawings.

.11 Shunt trip circuit breakers shall be as indicated on drawings c/w 120 VAC duty coils and two SPDT auxiliary switches.

.12 Where indicated on drawings, include the following circuit breaker options as specified.

.1 Shunt trip.
.2 Auxiliary position contacts NO/NC.
.3 Under-voltage release.
.4 On-off locking device.
.5 Solid state trip units.

2.2 MOULDED CASE CIRCUIT BREAKERS (MOTOR PROTECTION)

.1 Moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.

.3 Motor circuit protectors (MCP) are to be assembled in draw out unit wrappers.

.4 Common-trip: with through-the-door single handle mechanism for multi-pole applications.

.5 Magnetic instantaneous trip elements in motor protection circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 6 -15 times current rating.

.6 Motor Circuit Protectors (MCP) shall be provided complete with 120 VAC contactor coils and minimum of two SPDT auxiliary switches, or as otherwise indicated on the drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Identification: Provide Lamicoid plate on each MCC circuit breaker showing breaker tag number and load being fed.

.3 Adjust trip setting for system and feeder protections, motor circuit protection, and as per the protective device coordination study.

3.2 TESTING AND COMMISSIONING

.1 Perform tests and document results in accordance with Section 26 05 01 – Common Works Results for Electrical, Section 26 08 11 – Testing of Electrical Systems, and as per manufacturer’s recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, Enclosed Switches.

.2 CSA C22.2 No.39, Fuseholder Assemblies.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals.

.2 Include circuit breaker literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 “Heavy Duty” class, enclosed manual air break switches to CSA C22.2 No.4.

.2 Fuseholder assemblies to CSA C22.2 No.39.

.3 Fusible and non-fusible disconnect switch in CSA Type NEMA 4x enclosure in process areas and outdoors, and CSA Type NEMA 12 enclosure all other locations.

.4 Provision for padlocking in off switch position.

.5 Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor, or other high inrush current circuits

.6 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.

.7 Quick-make, quick-break action.

.8 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses where indicated or required.

.2 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 where indicated on the drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results for Electrical.

.2 Section 26 24 19 - Motor Control Centre.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with 01 33 00 - Submittals. Include:

- .1 Mounting method and dimensions.
- .2 Starter size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

.2 Include motor starter literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include operation and maintenance data for each type and style of starter.

1.4 EXTRA MATERIALS

.1 Provide listed spare parts for each different size and type of starter:

- .1 3 contacts, stationary.
- .2 3 contacts, movable.
- .3 1 contact, auxiliary.
- .4 1 control transformer.
- .5 1 operating coil.
- .6 2 fuses.
- .7 10% indicating lamp bulbs used.

Part 2 Products

2.1 FULL VOLTAGE NON-REVERSING MAGNETIC STARTERS

.1 Combination magnetic starters shall be installed in the motor control centre (MCC) of size, type, and rating as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type with auxiliary contacts as indicated.

.2 Intelligent electronic motor overload protective device for all three phases, manually reset from outside enclosure with ambient compensation, selectable trip class, phase loss, ground fault and jam protection as a minimum.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 Each starter to include a HOA switch with a secondary contact for the Auto status (wired to the intelligent electronic overload device).

.6 Ethernet I/P communication port or module.

.7 Ethernet IP communication shall be through the ethernet switch located in the motor control centre and directly connected to each starter and VFD without the requirement of additional gateway or communication devices.

.2 Combination magnetic starters to include motor circuit interrupter with operating lever on outside of MCC to control motor circuit interrupter, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

2.2 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with primary and secondary fusing, installed with each starter, as indicated on the drawings.

.2 Size control transformer for control circuit load plus 100% spare capacity.

2.3 PUSHBUTTONS

.1 Standard. Operator flush type, as indicated. Black with 1-NO and 1-NC contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position labeled “emergency stop”.

2.4 SELECTOR SWITCHES

.1 Maintained 3 position labeled as indicated, standard, operators’ standard knob, contact arrangement as indicated, rated 120 V AC, 10 A.

2.5 INDICATING LIGHTS

.1 Standard LED cluster, transformer type, push-to-test, lens colour: as indicated, supply voltage: 120 V AC, labels as indicated. Like Allen-Bradley, Bulletin 800, 800T-N77x.

.2 Pilot light colors, where indicated on the drawings:

.1 Green – Ready
.2 Red - Running
.3 Amber –Fault/Trip
.4 White – Cabinet Power

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results for Electrical.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated in drawings.

.2 Install auxiliary contacts and connect wiring.

.3 Ensure correct MCP settings and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Test and commission to plant PLC for remote control, status, and alarms.

.5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section describes the supply and installation of all variable frequency drives (VFDs).

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results for Electrical.

.2 Section 26 24 19 – Motor Control Centres.

1.3 REFERENCES

.1 All equipment shall be designed, manufactured, and tested in accordance with the applicable current CSA, EEMAC, ANSI, IEEE and NEMA standards and the latest edition of the following:

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

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

.4 ANSI C37-90.1 Guide for Surge Withstand Capability Tests.

.5 Equipment shall have CSA approval by a recognized certification agency.

.6 Equipment shall comply with the standard of the local electrical authority.

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

.8 CSA Standard C22.1 Canadian Electrical Code (current edition) as adopted by the Province of British Columbia.

.9 IEEE 519: Guide for Harmonic content and Control.

.10 IEC 61800-2 and -3 EN 50082-1 and -2 EMC immunity requirements.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals. Submittal to include standard catalogue sheets showing the following for each different Horsepower rated VFD provided:

.1 Full VFD model number.

.2 Voltage.

.3 Horsepower.

.4 Maximum current ratings.

.5 Line harmonic mitigation device and load filter.

.6 Recommended replacement parts with part numbers.

.2 Include VFD literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

1.5 WARRANTY

.1 1-year parts warranty shall be provided on materials and workmanship from the date of substantial performance.

1.6 QUALITY ASSURANCE

.1 The VFD (AC Drive) and all associated optional equipment shall be CSA certified. As verification, a CSA label shall be attached on the side of the drive controller.

Part 2 Products

2.1 MANUFACTURER

.1 Acceptable manufacturers for Variable Frequency Drives as supplied by the acceptable motor control centre manufacturer:

.1 AB (Allen Bradley), Vacon or Owner approved equal.

.2 All to include harmonic filters (or Owner approved equivalent) to limit harmonic distortion as specified herein.

.3 Alternate control techniques other than sine wave by pulse width modulation (PWM) are not acceptable.

2.2 GENERAL DESCRIPTION

.1 To assure a properly coordinated system, all drives and ancillary components shall be supplied by one manufacturer.

.2 Intent is each VFD, with respective line and load filters, are contained in a stand-alone enclosure, sized accordingly, and able to fit in the electrical room.

.3 Apply finishes in accordance with MCC specifications.

.4 The VFD supplier shall be responsible for coordinating 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.

.5 A load side long line reactor shall be provided when indicated on the drawings, or as required to protect motor winding from over-voltage due to long motor leads.

.6 Controlled acceleration and deceleration times, separately adjustable, shall be provided. When requested on the drawings, the supplier shall provide adjustable damping for the response to speed change.

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

.8 The AC drive shall be capable of regulating the frequency to a ±1% of the set point over the full input voltage and ambient temperature operating range.

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

.10 Audible noise levels produced by the AC drive shall be not greater than 85 dBA sound pressure when measured at one metre, at any point throughout the operating range of the drive.

.11 The AC drive input shall be protected to withstand surges as defined in ANSI Std. (C37.90.1 - 2012, Guide for Surge Withstand Capability (SWC) Tests.

.12 The VFD, when operating on diesel standby power generator, shall not cause the generator control system to malfunction due to VFD harmonic distortion introduced into the power system:

.1 This shall be tested by the Contractor and witnessed by the Owner's representative, prior to commissioning.

.2 The Contractor shall rectify any identified problems to the satisfaction of the Owner's representative at no extra cost to the Owner, to allow proper operation of the VFD utilizing standby generator power.

.13 Structures shall be totally enclosed dead-front, free-standing assemblies. They shall be front-mounted units. Structures shall contain a horizontal wireway at the top, isolated from the horizontal bus via metal barriers and shall be readily accessible through a hinged cover. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference.

.14 Adequate space for power and control wiring entering either the top or bottom of the MCC structure shall be provided without structural interference.

.15 Removable top cover plates shall be provided for conduit/cable entry to the top horizontal wireway and shall provide a minimum of 116 in^2 of area for cable installation location. Top cover plates shall be fabricated from 13-gauge steel.

.16 Dimension: MCC/VFD dimension shall fit within the electrical room space provided, as shown on contract drawings.

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

.18 Environmental Conditions: The VFD shall be suitable for use in normal indoor non-hazardous industrial environments subject to the following conditions.

.1 Ambient temperature range of 0 to 40°C.

.2 Humidity range from 5 to 95%, non-condensing.

.3 Altitude range up to 1000 metres without derating the VFD's output power capability.

.4 To ensure adequate heat dissipation the VFD unit shall include fan assisted cooling, with automatic thermostat control, such that it would not degrade the enclosure rating. The function of the fan thermostat shall be to maintain temperature within the drive and to extend life of the fan due to prolong idle time of the driven equipment.

.19 Drive Construction

.1 Design the VFD cabinet to provide for ease of maintenance.

.2 The VFD shall consist of the following major components:

.1 Input rectifier section to supply fixed DC bus voltage.

.2 Phase-to-phase and phase-to-ground MOV protection.

.3 Smoothing reactor for the DC bus.

.4 DC bus capacitors.

.5 The VFD shall employ PWM (pulse width modulated) inverter system utilizing Insulated Gate Bipolar Transistors (IGBT) power switching devices and shall include DC link filters.

.6 Suitable dv/dt filters (RLC output filter network) to control output voltage spikes and to control rise times of the output pulses, to permit use of long motor leads and control cables. Average cable lengths between the VFD and motor are 25 m.

.7 Built-in ground fault protection.

.8 Microprocessor to control PWM pulse generation, preferably a separate microprocessor specifically dedicated to PWM pulse generation.

.9 Provide input line filter to limit total harmonic distortion as specified herein (refer to clause “Filters”).

.10 The VFD shall have a current rating at least 10% more than the motor full load amp rating. Overload service factors of 110% for

thirty minutes and 135% for one minute must be provided to ensure adequate safety margins.

.20 In each VFD, include as standard, a door mounted operator interface module with backlit LCD display to configure VFD parameter, and display operation and fault code diagnostic information.

.21 Separate the VFD power terminal blocks physically from control signal terminal blocks.

.22 The VFD shall be modularly constructed. Provide printed circuit boards with plug-in connections and easily removable from the drive. Provide power components readily accessible with "fast-on" or screw terminal connections for easy removal. The control printed circuit board shall be interchangeable with all comparable HP ranges of VFD.

.23 Provide a complete inventory (as specified) of spare cooling fans, and fuses, for each VFD supplied.

2.3 MOTOR DATA

.1 The VFDs shall be sized to operate the motors defined in the drawing package.

2.4 APPLICATION DATA

.1 The VFD shall be sized to operate a constant torque load.

.2 The motor speed range shall be from a minimum speed of 6.0 Hertz to a maximum speed of 60 Hertz.

2.5 RATINGS

.1 The VFD shall be designed to operate from an input voltage of 525 to 690 VAC +/- 10%.

.2 The VFD shall operate from an input voltage frequency range from 45 to 66 Hertz.

.3 The displacement power factor shall not be less than .96 lagging under any speed or load condition.

.4 The efficiency of the VFD at 100% speed and load shall not be less than 97%.

.5 Where required, the constant torque rated VFD overcurrent capacity shall not be less than 150% for 1 minute.

.6 The output carrier frequency of the VFD shall be selectable from 1.0 to 6 KHZ depending on VFD rating. For low noise operation, derating may be required.

.7 The output frequency shall be from 0.1 to 320 Hertz.

2.6 PROTECTION

.1 Upon power-up the VFD shall automatically test for valid operation of memory, dynamic brake failure, power, and the pre-charge circuit.

.2 The VFD shall be protected against short circuits between input phases and/or output phases and ground. The VFD shall safely shut down without damaging any power circuit devices.

.3 For a fault condition, other than a ground fault, short circuit, or internal fault, an auto restart function should provide up to 10 programmable restart attempts with Lock-out after the last attempt. The programmable time delay before restart attempts will range from 1 to 60 seconds. This feature can be defeated if not required.

.4 The rotating motor auto start on power-up function could be enabled/disabled if required.

.5 The VFD shall be capable of running without a motor connected for setup and testing.

.6 The deceleration mode of the VFD shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, emergency stop and DC injection braking.

.7 Upon a loss of the analog process follower reference signal, the VFD shall fault and/or operate at a user defined speed set between software programmed low speed and high-speed settings.

.8 The VFD shall have solid state I^2t protection that is UL listed and meets UL 508 as a Class 10 overload protection and meets IEC 947. The minimum adjustment range shall be from 50 to 110% of the current output of the VFD.

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

.1 Under/over voltage.
.2 Incoming power system phase loss
.3 Overcurrent.
.4 Overtemperature.
.5 Output short circuit
.6 Output ground fault.
.7 Output power phase loss and current imbalance
.8 DC Bus overvoltage
.9 Inverter Over-temperature
.10 Stall.

.10 There shall be a minimum of 2 skip frequency ranges that can each be programmed with a programmable bandwidth from 0 to 10Hz. The skip frequencies shall be programmed independently, back to back or overlapping.

.11 The VFD shall have an internal over temperature protection.

2.7 ADJUSTMENTS AND CONFIGURATIONS

.1 If required, a password should be available to allow the terminal keypad to be locked out from unauthorized personnel.

.2 The acceleration and deceleration ramp times shall be adjustable from 0.1 to 3000.0 seconds.

.3 The memory shall retain and record run status, operating time, fault type of the past 10 faults.

.4 Slip compensation shall be a software enabled function.

.5 As a minimum, the following parameters shall be accessible:

.1 Maximum speed
.2 Minimum speed
.3 Current limit
.4 Thermal overload
.5 Restart limit
.6 Skip frequency and bandwidth
.7 Preset speed

2.8 OPERATOR INTERFACE

.1 A door mounted Hand-off-Auto selector switch shall allow the VFD to be controlled fully by the PLC (Auto/Remote) or through the Local Operator Interface (LOI).

.2 Local Operator Interface (LOI) on VFD Front Door:

.1 Provide a digital local operator interface with LCD display on the VFD door complete with the following features as a minimum.

.1 START pushbutton for local control.
.2 STOP pushbutton for local control.
.3 Speed raise/lower pushbuttons with digital frequency display for local speed adjustment.
.4 FAULT RESET pushbutton (or built into the STOP pushbutton).
.5 VFD RUN indicator.
.6 VFD FAULT indicator.

.7 Parameter selection and programming capability

.2 The VFD to shut down in a controlled fashion when operator station is disconnected.

.3 Speed Control

.1 Speed control mode selection as follows:

.1 Hand: Speed from the VFD LOI keypad setting.

.2 Remote: Speed from PLC cabinet via hardwired 4-20mA communication. Provision for Ethernet/IP communication for entire drive operation to be included (option may be exercised during final shop drawing reviews.

.4 Control Functionality

.1 Field selector switch to "Auto" enables the motor to be started, stopped and speed controlled by the PLC.

.2 Field selector switch to "Hand" enables motor to be started, stopped and speed controlled through the drive LOI (LCD display panel).

.3 Drive panel selector switch to "Off" stops the motor with soft-stop.

.4 VFD LOI shall be able to override field selector switch.

.5 The Owner’s programming representative will program the PLC to control and monitor the VFD's in accordance with the control philosophy included in the specifications.

.5 The operator interface terminal should feature and alphanumeric display with seven indicators for speed controller status (Run, direction, ready stop, alarm, fault) and three indicators for control (I/O terminal, keypad, bus/communication). There are also three LEDs indicators green/red/amber for Ready, Run, Fault. The terminal should allow the modification of VFD adjustments via a keypad. All electrical values, configuration parameters, application and activity function access, faults, local control, adjustment storage will be in plain English.

.6 The display will be a high resolution, LCD backlighted screen capable of displaying two lines of alphanumeric characters. The use of coded or abbreviated displays shall not be acceptable.

.7 The following monitoring values shall be accessible and available when in the operating mode:

.1 Frequency (Hz) and/or motor speed (RPM)

.2 Motor current (A), motor voltage (V), motor torque (%), motor power (%)

.3 Drive temperature (^{o}C)

.4 Motor temperature (%)

.5 Values or status of analog I/O, digital I/O

.8 The operator terminal shall allow the user to display up to three user selectable monitoring values on the same screen at a time.

.9 The operator terminal shall offer a general menu consisting of parameter setting, fault history, and drive configuration. A software lock with password will limit access to the main menu or parameters.

.10 There will be function keys that allowing the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.

.11 A data entry key will allow the user to confirm a selected menu or numeric value.

.12 A RESET key will allow a parameter to return the existing value if adjustment is not required and the value is displayed.

.13 The VFD shall have a LED on the keypad to indicate RUN status of the drive.

2.9 FILTERS

.1 The VFD manufacturer shall provide harmonic filters, dv/dt filter, RFI filters and TIF filters, plus all accessories to meet performance criteria as defined herein.

.2 Controllers shall have acceptable filters and enclosures to limit interference and noise as noted in the Specifications.

.3 Unless otherwise noted, these criteria shall be at each VFD drive disconnect switch (breaker); which, for this project, will be defined as the “point of common coupling”.

.1 Performance Criteria - Harmonic Distortion.

.1 Harmonic loading will not exceed a motor service factor of 1.0

.2 Maximum individual voltage harmonic distortion shall be less than 3% (of fundamental) at the VFD breaker.

.3 Maximum total voltage distortion (THDv) of waveform (% of fundamental) at the VFD breaker shall be less than 5%.

.4 Maximum harmonic current distortion of waveform (% of fundamental) at the point of common coupling with the filter connected shall be:

.5 Where h is the harmonic multiple of the 60 Hz base frequency

.6 $h < 11$ = 7.0%

.7 $11 < h < 17$ = 3.5%

.8 $17 < h < 23$ = 2.5%

.9 $23 < h < 35$ = 1.0%

.10 $35 < h$ = 0.5%

.11 The ratio ISC/IL (ratio at short circuit current available at VFD breaker to maximum fundamental load current) is 25.

.12 Total harmonic demand distortion (TDDi) shall be less than 8% when measured at the VFD breaker.

.13 Provide components as required to de-tune the system to eliminate destructive overcurrents and overvoltages.

.14 Compliance may be verified with on site field measurements of both the voltage and current harmonic distortion at the VFD breaker by comparison with and without the VFD's operating.

.2 Performance Criteria - RFI and TIF

.1 Acceptable level of telephone interference factor TIF shall be less than 400 with IT less than 10,000 balanced, at the VFD breaker.

.2 RFI shall be removed from conductive paths with filters on inputs and outputs of the system. Enclosure shall be shielded.

.3 RFI filtering shall limit radio frequency interference to meet FCC Class A radiation limits. This standard allows a maximum field strength at 30 metres of:

.1 30-80 MHz, 300 mV/m

.2 88-216 MHz, 50 mV/m

.3 216-1000 MHz, 70 mV/m

.4 Passive Harmonic Filters

.1 The harmonic mitigation equipment and all its components shall be manufactured and tested in accordance with the latest applicable standards of UL, CSA and NEMA.

.2 Demonstration of compatibility between the harmonic mitigation equipment and the VFD must be available upon request.

.3 Harmonic mitigation equipment shall be warranted to be free of defects in materials and workmanship for a period of 24 months from the date of start-up or 30 months from the date of shipment.

.4 Factory Performance Testing: Manufacturer must be capable of factory testing for harmonic mitigating performance and energy efficiency under actual variable frequency drive loads. A detailed description of the program and a sample test report must be provided at time of Tender.

.5 Subject to compliance with all the contract documents and specifications, the acceptable filter manufacturers are MIRUS International Inc., MTE Matrix Harmonic Filter, or approved equivalent.

.6 The harmonic mitigation equipment must never introduce a capacitive reactive power (KVAR), which is greater than 20% of its kVA rating.

.7 The harmonic mitigation equipment shall be supplied with a relay/contactor to remove any capacitive components from the circuit when operating on generator. The signal to open the contactor will come from the facility’s PLC control system.

.8 The harmonic mitigation equipment shall not resonate with system impedances or attract harmonic currents from other harmonic sources.

.9 The full load efficiency of the harmonic mitigation equipment / VFD combination shall be greater than 96%. The harmonic mitigation equipment itself shall have efficiency no less than 98%.

.10 All inductor and wiring shall be copper.

.11 Insulation class: 220°C system. Temperature rise: 130°C

.12 Anti-vibration pads shall be used between the reactor or transformer core and the enclosure.

.13 Intent is for the harmonic mitigation equipment to be install with the VFD in the MCC structure. If required to be mounted remotely, acceptance by Engineer is required, and shall be installed in a NEMA 1 gasketed enclosure.

.14 Submit for approval before shipment certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

2.10 CONTROL

.1 External pilot devices shall be able to be connected to a terminal strip for starting/stopping the VFD, speed control and displaying operating status. All outputs will be software assignable.

.2 The control power for the digital inputs and outputs shall be internally derived 24 VDC.

.3 There will be two (2) analog inputs. The analog inputs will be hardware selectable and consist of the following configurations: 0(4)–20 mA, 0-10V, or +/- 10V.

.4 There will be six (6) digital input that shall be individually user assignable to perform the various control functions available.

.5 There will be one (1) software assignable analog output that can be selected and assigned in the software. The analog output assignments shall be programmable 0(4)-20 mA or 0-10V.

.6 Two form “C” configurable 120 VAC rated, relay output contacts and an open collector output (24 VDC) to power a relay or pilot light, shall be provided. Each shall be programmable to indicate one of the following:

.1 Run
.2 Fault
.3 Ready
.4 At speed
.5 Current limit
.6 Follower present
.7 Auto speed mode
.8 Reverse indicator
.9 PID control active
.10 Over-temperature alarm

.7 There shall be available additional hardware input / output cards for incorporating alternate control signals including AC voltage logic inputs, PTC thermistor inputs and encoder feedback inputs.

2.11 COMMUNICATIONS

.1 Each VFD shall include a communication card or module suitable for the following protocol: Ethernet/IP.

Part 3 Execution

3.1 INSPECTION

.1 Verify that the location is ready to receive the equipment and the dimensions are as indicated.

.2 Do not install VFD, whether installed in MCC or separately enclosed, until the building environment can be maintained with the service conditions required by the manufacturer.

3.2 FACTORY TESTING

.1 Factory test shall be performed to verify that the VFD systems conform to the Specifications.

.2 Tests shall be performed to verify the proper operation of all control devices, input and output signals, local control functions and indication, and alarm points.

.3 The Contractor shall ensure shaft-to-ground voltages do not exceed 1.5 volts at any speed or load requirement. Damage to motor shaft and bearing due to excessive voltage spikes causing arcing at the bearing shall be repair at Contractor’s expense.

.4 It is the intent of this specification to provide a VFD installation that does not adversely affect any electrical system in the building.

.5 Provide certified copies of all production test results required by CSA and NEMA.

.6 The Owner representative reserves the right to witness the factory tests. Notify the Owner Representative ten (10) working days in advance that the assembly is ready for testing.

3.3 PROTECTION

.1 Before and during the installation, the VFD equipment shall be protected from site contaminants.

3.4 INSTALLATION AND COMMISSIONING

.1 VFDs shall be installed in a stand-alone enclosure. Installation shall follow manufacturer's instructions, drawings, and recommendations.

.2 The Contractor shall include the services of the VFD manufacturer's factory trained service representative to inspect and approve the VFD installation, program and set up VFD, and supervise testing and commissioning.

.3 Test and commission hardwired communication to plant PLC for remote control, status, and alarms. Ethernet/IP commissioning to also be included in pricing for work.

.4 The Contractor will conduct a harmonic analysis upon completion of fine tuning and commissioning phase of the installation. The harmonic analysis will be conducted at 50%, 75%, and 100% speed under normal load conditions and perform a Fourier transform (FFT) analysis spectrum for each waveform covering the fundamental to the 31st harmonic. Should the waveform analysis indicate that either the input or output voltage and current levels of the VFD(s) exceed NEMA Standards for electric motors and IEEE 519, or requirements of this specifications, then the Contractor shall provide, at their cost, all the necessary line filtering equipment to correct the harmonic distortion to the levels specified.

3.5 TRAINING

.1 An on-site training course of 1 day shall be provided, by a representative of the VFD supplier, to plant operators and maintenance personnel.

3.6 INSPECTION/MAINTENANCE

.1 The VFD manufacturer shall have a factory trained service representative located on Vancouver Island or the lower mainland, available for inspection and maintenance, when required. The VFD manufacturer's representative shall be trained in the maintenance and troubleshooting of the equipment as specified herein.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Provide surge protection device (SPD) at power panels and vendor panels, and where shown on the drawings.

1.2 REFERENCE STANDARDS

.1 Conform to the following reference standards:

.1 Canadian Electrical Code as adopted by the Province of British Columbia (CEC).
.2 ANSI/IEEE C62.41.
.3 ANSI/IEEE C62.45.
.4 UL 1449, latest edition.
.5 UL 1283.

1.3 SUBMITTALS

.1 Shop Drawings: Submit with the related items of equipment in accordance with contract documents.

.2 Provide verification that the SPD complies with the required ANSI/UL 1449 (Latest Edition) listing by UL.

.3 Provide shop drawing information with the following at a minimum:

.1 Model Number.
.2 SPD Type.
.3 System Voltage.
.4 Phases.
.5 Modes of Protection.
.6 Voltage Protection Rating (VPR).
.7 Nominal Discharge Current.
.8 Electrical/Mechanical drawings showing unit dimensions, weights, installation instructions and wiring configuration.

1.4 CLOSEOUT SUBMITTALS

.1 Operating and Maintenance Data: Provide with the related item of process equipment for incorporation in operation and maintenance manual as specified in Contract Documents.

1.5 COORDINATION

.1 Section 26 24 17 – Panelboards.

.2 Section 26 24 19 – Motor Control Centres.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURER

.1 Preference is for Surge Protective Device (SPD) to be of the same manufacturer as the panel board.

2.2 ELECTRICAL REQUIREMENTS

.1 Devices shall be rated 200kA per phase, 100kA per mode for Motor Control Centres on system voltage 347/600V, 3 phase, 4 wire grounded wye, where the neutral will not be continued to the MCC bussing.

.2 The MCC SPD shall be UL 1449 ‘Type 1’ or ‘Type 2’ and installed after the main overcurrent protection device of the MCC. The SPD shall have integral overcurrent protection.

.3 Power distribution systems; 120/208V, 3 phase, 4 wire grounded wye.

.4 Maximum Continuous Operating Voltage of all Suppression Components:

.1 125% of facility's nominal operating voltage for 120 V systems.

.2 115% of facility's nominal operating voltage for 240, 347, 480, 600 V systems.

.5 Operating frequency: from 50 to 62 Hz.

.6 Protection Mode: The unit shall provide protection on wye configured systems for:

.1 line to neutral transients.

.2 line to ground transients.

.3 line to line transients

.4 neutral to ground transients.

.7 Surge protection devices shall be designed, manufactured, and tested in accordance with UL 1449 (Latest Edition).

.8 All SPDs applied to the system shall have a nominal discharge current of 20kA, regardless of their SPD Type or operating voltage.

2.3 SPARE PARTS

.1 A list of customer replaceable spare parts shall be included with the installation, operating and maintenance instructions.

2.4 PERFORMANCE

.1 Unit shall include an engineered solid-state high-performance hybrid suppression system utilizing an array of selenium cells and/or non-linear voltage dependent metal oxide varistors and capacitive filter components. The suppression system shall not utilize gas tubes, spark gaps, or silicon avalanche diodes.

.2 The maximum UL 1449 3rd edition VPR for the device shall not exceed the following:

Modes	208Y/120	600Y/347
L-N; L-G; N-G	700	1500
L-L	1200	3000

2.5 ENCLOSURE

.1 Integral to MCC and/or panelboards.

2.6 FILTERING

.1 The unit shall contain a high-performance EM/RFI noise rejection filter. The filter shall reduce fast rise-time, high frequency, error producing transients and electrical line noise to harmless levels. The filter shall provide minimum insertion loss utilizing MIL-STD-E220A 50-ohm methodology as follows:

Attenuation Frequency	100 kHz	1 MHz	10 MHz
Attenuation (dB)	50	56	54.

2.7 STATUS INDICATION

.1 The unit shall include LED indicators, which provide indication of suppression component failure for all modes including neutral to ground. In addition to the LED indicators provide one (1) set of dry contacts for remote monitoring of protection failure. Contacts to activate upon failure of any one phase or degradation of total surge capacity to less than 75%.

.2 All units shall be testable in the field to verify the exact level of protection remaining using either built-in features or a hand-held tester.

2.8 DIAGNOSTIC MONITORING

.1 All units shall provide the following levels of diagnostic monitoring:

.1 Continuous monitoring of internal fuses and be equipped with the ability to alarm in event of a failure or blown fuse.

.2 Internal sensor system for monitoring MOVs including neutral to ground.

.3 Monitoring and adequate protection for temporary over voltage (TOV) condition.

2.9 PROTECTION

.1 Integral fusing shall be provided that provides proper fault protection per the CEC in the event of MOV failure but does not operate during normal operation where the unit is required to conduct an 8 x 20μs surge current equal to its per mode rating. Vendor shall provide independent single pulse test data verifying that the unit can withstand it's advertised per mode surge rating per NEMA LS1 and IEEE/ANSI C62.45.

.1 Fusing shall be rated to 200kAIC.

.2 Thermal Protection: MOV's shall be equipped with thermal protection technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30A, or if the occurrence is over a longer period, the thermal protection will disconnect first. Manufacturers that utilize fuse traces only shall not be approved.

.3 All overcurrent protection components shall be tested in compliance with UL 1449 - Limited Current Test and AIC rating test.

Part 3 Execution

3.1 INSTALLATION

.1 Install units integral to equipment.

.1 SPD shall be factory installed inside the panel board at the assembly point by the original equipment manufacturer.

.2 Suppressor shall be installed on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.

.3 The SPD shall be connected through a disconnecting means (30A circuit breaker). The disconnect shall be in the immediate proximity of the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

.4 Suppressor's ground shall be bonded to the service entrance ground.

.5 All monitoring and diagnostic features shall be visible from the front of the equipment, without the need to expose any live parts.

.2 Install units integral to distribution panelboards, where indicated on the drawings.

.1 Install one secondary suppressor at each location or as required.

.2 SPD shall be interfaced to the panel board via a direct bus bar connection

.3 The SPD shall not limit the use of through-feed lugs, sub-feed lugs and sub-feed breaker options.

.4 SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main-lug only panelboards shall be installed immediately following the incoming main lugs.

.5 The SPD shall be included and mounted within the panel board by the manufacturer of the panel board and shall be of the same manufacturer as the panel board.

.3 Provide, 2C #14 AWG connection from each unit to the PLC cabinet for monitoring by the facility control system.

.4 Where units are mounted integral with panelboards, status LEDs shall be visible without removing covers.

3.2 TESTING AND COMMISSIONING

.1 Perform tests and document results in accordance with Contract Documents.

.2 For each item of equipment, attach test documentation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 WORK INCLUDED

.1 The Contractor shall furnish and install as shown or specified herein all conduit, wire, lighting luminaires, lighting systems and lighting controls. The section shall include but not be limited to:

.2 Lighting Luminaires and Supports.

.3 Lamps.

.4 Exterior Lighting Control.

.5 Ballasts.

.6 Accessories.

1.3 COORDINATION WITH OTHER SECTIONS

.1 Coordinate with other Divisions to avoid conflicts between luminaires, landscaping, supports, fillings, civil works, and mechanical equipment.

1.4 SUBMITTALS

.1 Submit Shop Drawings for all luminaires in accordance with Section 01 33 00 – Submittals and indicates complete model number(s) and provides all pertinent physical characteristics.

.2 Construction and performance of luminaires, subject to approval of the Engineer.

.3 Provide, if requested by the Engineer, complete photometric data, and heat dissipation reports from independent testing laboratory.

1.5 SAMPLE LUMINAIRES

.1 Submit for approval of the Engineer one of each luminaire type if requested before manufacturing commences. If directed by Engineer, set up luminaire to show coordination with ceiling, mechanical diffuser assemblies, and other equipment. Luminaire, if approved, will be retained as a control standard. Luminaires not approved to be resubmitted.

Part 2 Products

2.1 PRODUCTS

.1 Luminaires supplied shall be LED and in accordance with the luminaire schedule shown on the drawings.

Part 3 Execution

3.1 LIGHTING INSTALLATION CHECK LIST

.1 Luminaires are mounted and secured in an approved manner.

.2 Luminaires are free of scratches, dents, breaks, paint, or defects.

.3 Luminaires are clean and lamped.

.4 Luminaires are fully operational.

.5 Lighting levels appear to be adequate for the space, task, and occupant type.

.6 Lighting levels for areas requiring general illumination are uniform.

.7 Color temperature and color rendering (CRI) of lamps agrees with specifications and drawings.

.8 Lamp wattages conform to specifications and drawings.

.9 Lamps are operating properly.

.10 Ballast noise is not excessive or unusual. Ballasts are sound rated as per specification.

.11 Luminaires are approved for the location in which they are placed.

.12 Lighting equipment and lamps are new.

.13 Luminaires are supplied and installed are as per the luminaire schedule.

.14 Spare lamps and parts are available as per specifications.

.15 Luminaires that are required to be aimed or directed are aligned to produce the desired results.

.16 Wattages recommended as maximums for use in a luminaire are not exceeded.

.17 Overcurrent protection of lighting loads meets code standards.

.18 Pendant mounted luminaires do not place undue strain on any part of the lighting support system. Ball aligners or a flexible fitting are used whenever conduit stems over 300 mm are encountered.

.19 Recessed downlights are rated for mounting conditions (if recessed downlight is blanketed with insulation it must be approved as such).

.20 Teck 90 rated conductors are used to supply the source to the luminaires.

.21 Flexible wiring to recessed luminaires laid within a T-bar ceiling is independently supported.

.22 Polarized lamp holders are properly connected (white wire goes to screw shell and the black wire goes to the center pin).

.23 Luminaires are bonded.

.24 Suitable guards, screens or materials are used on luminaires that are in areas subject to mechanical damage.

.25 Acrylic material or better to be used as lens material for luminaires. Styrene not permitted.

.26 Illumination levels are adequately provided by the emergency lighting system if normal power is lost.

.27 Emergency lighting battery packs (unit equipment) are connected to an un-switched AC source.

.28 Voltage drop to remote mounted emergency light within the allowable code limit.

.29 Illuminated exit signs located as per code and as per the requirements of the specifications and drawings.

.30 Exit signs are illuminated when normal power is lost.

.31 LED type of illuminated exit signs are used wherever and whenever possible.

.32 Emergency lighting system is tested.

.33 Illuminated exit signs are supplied from a dedicated electrical circuit or circuits.

.34 Outdoor pole mounted luminaires are adequately and effectively supported and protected against physical damage.

.35 Poles supporting luminaires are free of defects, dents, scratches, and other imperfections.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 26 05 21 - Wires and Cables (0-1000 V).

.2 Section 26 05 34 - Conduits, Conduit Fastenings, and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00. Include:

.1 System components.
.2 Mounting method.
.3 Source of power.
.4 Special attachments.

.2 Include emergency lighting literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: as indicated.

.3 Output voltage: 12 V DC or as indicated.

.4 Operating time: 60 min or as indicated.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state.

.10 Lamp heads: remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED with wattage as shown on the luminaire schedule.

.11 Cabinet: NEMA 12 rated, suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: white.

.13 Auxiliary equipment:

.1 Test switch.
.2 Shelf or mounting bracket.
.3 Cord and plug connection for AC.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings, and Conduit Fittings.

.2 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations.

2.3 DRAWINGS

.1 Refer to lighting luminaire schedule on drawings for specific suppliers and models.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights emergency supply to emergency lighting unit equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

.2 CSA C860, Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA) requirements.

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals. Product data sheets for exit lights to include:

.1 Performance criteria.

.2 Physical size / dimension drawings

.3 Equipment finish.

.2 Include exit signs literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical. Manufacturer's Instructions to indicate special handling criteria, installation sequence, cleaning, and maintenance procedures.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.

.2 Housing: extruded aluminum housing, brush aluminum finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: LED.

.5 Operation: designed for 100,000 hours of continuous operation without relamping.

.6 Replaceable chevron green "running man" faceplate.

.7 Downlight: translucent acrylic in bottom of unit.

.8 Face plate to remain captive for relamping.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit lights.

.2 Connect fixtures to exit light and emergency circuits as specified on drawings.

.3 Ensure that exit light circuit breaker is locked in the “on” position.

END OF SECTION

Part 1 General

1.1 DEFINITIONS AND INTERPRETATIONS

.1 Where the term "Provide" is used herein, it shall be understood to include labour, materials, and services necessary to supply items or work referenced.

.2 Where the terms "Instructions" or "As Instructed" or "Where Instructed", are used herein, they shall be understood to mean as instructed by the Engineer including supplementary instruction notices and all comments made regarding submittals of Shop Drawings and samples for review.

.3 Where the term "Listed" is used herein, it shall be understood to mean that the materials or equipment have been tested in accordance with applicable standards and methods, have been approved and listed for the intended use by a testing authority which itself has been approved by the authorities having jurisdiction.

.4 Where the terms "Approved", or "Approval", are used herein, they shall be understood to mean approved by Authorities having jurisdiction as conforming to Codes, Standards, Bylaws, etc.

.5 Where the terms "Acceptable", or "Acceptance", are used herein, they shall be understood to mean acceptable to the Engineer as generally conforming to the requirements of the Contract Documents.

.6 Where the term "Submit for Review" is used herein, it shall be understood to mean submit to the Engineer.

.7 Where the term "Subject to Review" etc. is used herein, it shall be understood to mean work shall be laid out for review by the Engineer. No work shall proceed until instructions have been obtained from the Engineer. Submit further information, Shop Drawings, samples, etc. as specified and/or as may be reasonably requested by the Engineer.

.8 Where the term "Accessible" is used herein, it shall be understood to mean readily approachable by person or tools as required and where obstacles may be removed and replaced without cutting or breaking out materials.

.9 Where working pressure or pressure ratings are specified or shown on the Drawings for valves, piping, fittings, equipment, etc., these items shall be suitable for operating at specified pressures and corresponding temperature unless noted otherwise.

1.2 SHOP DRAWINGS

.1 Refer to the submittal requirements specified in Division 1 for the general requirements for Shop Drawings.

.2 In addition to the requirements specified in Division 1, submit the following specific information where applicable with Shop Drawings.

.1 Assembly drawings showing details of connections and termination of equipment for connection by others, if any.

.2 List of materials of construction, detailing the component parts and reference specifications (ASTM, CSA, ANSI, etc.).

.3 Motor operating data, including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances, and description of construction, complete with illustrative drawings.

.4 Gearbox and drive data, including AGMA/ABFMA ratings for components, materials of construction, tolerances, and description of construction.

.5 Control schematics, text and wiring diagrams as required to describe control operations.

.6 Required ancillary services including but not limited to electrical, non-potable water and drains.

.7 Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances and points of connection for ancillary services.

.8 Start-up instructions including lubricant requirements, electrical requirements, etc.

.9 Details of coating systems to be applied.

.10 Details of insulation provided to prevent galvanic corrosion between mating surfaces constructed of dissimilar metals.

.11 Design criteria used to size equipment, including but not limited to, flow rate, pressure, headloss, etc.

.12 Where applicable isometric layouts of equipment, piping, and fittings.

.13 A copy of the Contract Documents mechanical layout drawings, control diagrams, and process and instrumentation diagrams, with addenda updates, that apply to the equipment marked to indicate special changes necessary for the supplied equipment. If no changes are required, mark the drawing(s) "No Changes Required".

.14 A copy of the related Specification section with addenda updates, and all referenced sections with addenda updates, with each paragraph check marked to show Specification compliance or marked to show deviations.

1.3 TEMPORARY USAGE

.1 Temporary usage by the Owner of any process device, apparatus, machinery, or equipment prior to interim or final inspection is not to be construed as acceptance.

1.4 OWNER SUPPLIED EQUIPMENT

.1 Where indicated in the Drawings or noted in the Specifications, the Contractor shall install, test and commission Owner supplied equipment.

.2 The Contractor will review all information available for the Owner supplied equipment and be familiar with all requirements for storage, installation, testing, commissioning and hand-over.

.3 The hand-over of Owner supplied equipment shall be made according to a schedule agreed upon by the Contractor, the Engineer, and the Owner.

.4 Upon hand-over, the Contractor will fully inspect the item of equipment in the presence of the Engineer. Where the equipment requires modification or repair to properly function, these items will be identified to and confirmed by the Engineer.

1.5 DESIGN STANDARDS, ACCEPTABLE PRODUCTS AND ACCEPTABLE MANUFACTURERS

.1 Equipment lists included in the Specifications may be in two (2) parts. The first part is the "Design Standard" equipment items. The second part of the list is comprised of "Acceptable Manufacturers" if the equipment of a specific vendor is specified.

.2 The design has been based on the Design Standard. Quality of workmanship, dimensions, operating protocol, basic materials, and ancillary services have been defined on this basis and incorporated in the design.

.3 Where Acceptable Products or Acceptable Manufacturers have been listed after a Design Standard, these products or ranges of products have been accepted by the Engineer as being capable of meeting the basic functional requirements of the equipment, but may not be the same as the Design Standard in detail. Provide all ancillary services, material upgrades, etc. as necessary to satisfy the quality requirements defined by the Design Standard. Make all minor changes in arrangement, piping and / or electrical connections, etc. as necessary to suit the requirements of the Acceptable Products or Acceptable Manufacturers.

.4 Where Acceptable Products or Acceptable Manufacturers have been listed, but no Design Standard is listed, these products or ranges of products have been accepted by the Engineer as being capable of meeting the basic functional requirements of the equipment. Provide all ancillary services and minor modifications to arrangement, piping and / or electrical connections, etc. as necessary to suit the functional requirements of the equipment.

.5 No additional payment will be made for revisions or alterations made to accommodate the equipment supplied.

1.6 ABBREVIATIONS

.1 The following abbreviations are found in the Process Specifications:

- ABFMA - American Bearing Fabrication and Manufacturer's Association
- AGMA - American Gear Manufacturer's Association
- AISI - American Iron and Steel Institute
- ANSI - American National Standards Institute
- ASTM - American Society for Testing and Materials
- AWS - American Welding Society
- CEMA - Conveyor Equipment Manufacturer's Association
- CGSB - Canadian Government Standards Board
- CSA - Canadian Standards Association
- DIN - Deutsche Industries Norm
- EEMAC - Electrical Equipment Manufacturer's Association of Canada
- ISA - Instrumentation Society of America
- MSS - Manufacturer's Standardization Society of the Valve and Fittings Industry
- NEMA - National Electrical Manufacturer's Association
- NACE - National Association of Corrosion Engineers
- SSPC - Structural Steel Painting Council

Part 2 Products

2.1 GENERAL REQUIREMENTS

.1 Noise Level: When in operation, no single piece of equipment shall exceed the OSHA noise level requirement of 75 dBA for one-hour exposure per day.

.2 Potable water contact: Materials immersed in or exposed to potable water shall be listed as compliant with NSF Standard 61.

.3 Protection of Equipment: Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided to prevent accumulation of condensate in gears and bearings. In addition, motor space heaters shall be energized, and shafts shall be rotated. Equipment delivered to the Site with rust or corroded parts shall be rejected. If equipment develops defects during storage, it shall be disassembled, cleaned, and recoated to restore it to original condition.

.4 Identification of Equipment Items

.1 At the time of shipping, each item of equipment shall have a legible identifying mark corresponding to the equipment number for the item.

.2 After installation, each item of equipment shall be given permanent identification.

.5 Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the Shop Drawings

.6 Controls: Equipment and system controls shall be in accordance with Divisions 25, 26 and 27.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

.1 Equipment Supports: Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of as required by the governing building code or 10 percent of gravity. Submitted design calculations for equipment supports shall bear the signature and seal of an engineer registered in the Province wherein the project is to be built, unless otherwise indicated. Calculations shall account for forces and distribution of forces on supporting structures resulting from normal operation, normal operation plus seismic loadings, and normal operation plus wind loadings.

.1 Wall-mounted equipment weighing more than 250 pounds, or which is within 18-inches above the floor shall be provided with fabricated steel supports. Pedestals shall be of welded steel. If the supported equipment is a panel or cabinet or is enclosed with removable sides, the pedestal shall match the supported equipment in appearance and dimensions.

.2 Seismic requirements: Freestanding and wall-hung equipment shall be anchored in place by methods that satisfy the building code. Calculations shall be performed and signed and stamped for equipment weighing more than 400 pounds. Calculations shall analyze lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5 or per Contract Drawing requirement. Calculations shall include the distribution of forces imposed on the supporting structure and anchors, verifying that each anchor can develop the required resistance forces.

.3 Wind requirements: Exterior freestanding equipment shall be anchored in place by methods that satisfy the building code. Calculations shall be performed and signed and stamped, analyzing lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. Calculations shall include the distribution of forces imposed on the supporting structure and anchors, verifying that each anchor can develop the required resistance forces.

.2 Anchors: Anchor bolts shall be in accordance with Section 05 50 00. Manufacturer shall determine the size, type, capacity, location, and other placement requirements of anchorage elements. Anchoring methods and leveling criteria in the manufacturer's literature shall be followed. Submit methods and criteria with the Shop Drawings.

.3 Equipment Foundations: Mechanical equipment, tanks, control cabinets, enclosures, and related equipment shall be mounted on minimum 3.5-inch high concrete bases, unless otherwise indicated. The Contractor through the equipment manufacturer shall verify the size and weight of equipment foundation to insure compatibility with equipment.

2.3 PIPING CONNECTIONS

.1 Pipe Hangers, Supports, and Guides: Pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Submit calculations to justify pipe hangers, supports and guide’s spacing.

.2 Flanges and Pipe Threads: Flanges on equipment and appurtenances shall conform to ASME B16.1, Class 125, or B16.5, Class 150, unless otherwise indicated.

.3 Flexible Connectors: Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment and in piping. Flexible connectors shall be harnessed or otherwise anchored to prevent separation of the pipe where required by the installation.

.4 Insulating Connections: Insulating bushings, unions, couplings, or flanges, as appropriate, shall be used.

2.4 EXPANSION JOINTS

.1 Select materials suitable for service commodity, temperature, and pressure. Both steel and elastomer materials are acceptable.

.2 Provide control rods –if required - on expansion joint connectors to prevent excessive axial elongation and to accept the static pressure thrust in the piping system. Manufacturer to determine number and sizes of control rods.

.3 Materials to conform to NSF61 standards for contact with potable water

.4 Minimum lateral, compression and elongation movement is 25 mm each.

.5 Flanged connections to conform to ANSI B16.5 standards.

.6 Acceptable manufacturers are:

- Senior Flexonics.

- Garlock.
- Mercer.
- Techniquip.
- Approved equivalent

2.5 BASKETS AND PACKINGS

.1 Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane Everseal, or equal.

.2 Packing around rotating shafts (other than valve stems) shall be "O" rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer and approved by the Engineer.

2.6 NAMEPLATES

.1 Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.7 TOOLS AND SPARE PARTS

.1 Tools: The Manufacturer shall furnish one complete set of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment if required. Tools shall be of best quality hardened steel forgings with bright finish. Wrench heads shall have work faces dressed to fit nuts. Tools shall be suitable for professional work and manufactured by Snap On, Crescent, Stanley, or equal. The set of tools shall be neatly mounted in a labeled toolbox of suitable design provided with a hinged cover.

.2 Spare parts shall be furnished as indicated in the individual equipment sections. The lists in these sections are intended to include all parts which normally would be required within a single year for normal preventative maintenance and where fabrication requirements for special parts would delay delivery and could keep an item of equipment out of service for an extended period.

.3 Spare parts shall be suitably packaged in a metal box and labeled with equipment numbers by means of stainless steel or solid plastic nametags attached to the box.

.4 Any special spare parts not listed shall be identified by the Contractor, with a price list.

.5 In addition, the Contractor shall provide a list of all spare parts, not including lubricants, which normally would be required through the first five (5) years of operation. Provide prices for each part, guaranteed for six (6) months.

.6 The Contractor shall be responsible to replenish the spare parts used in the initial year of operation at the end of the maintenance period for the related item(s) of equipment.

2.8 EQUIPMENT LUBRICANTS

.1 The Manufacturer shall provide lubricants for equipment during shipping, storage, and prior to testing, in accordance with the manufacturer's recommendations. After successful initial testing, final testing, and satisfactory completion startup testing the Contractor shall conduct one complete lubricant change on all equipment. In addition, the Contractor shall be responsible for the proper disposal of used lubricants. The City will then be responsible for subsequent lubricant changes

2.9 GUARDS

.1 On moving parts, provide sheet steel guards in accordance with workplace safety regulations. Fabricate of 14-gauge steel and galvanize after construction.

.2 Guards shall be removable to facilitate maintenance of moving parts.

Part 3 Execution

3.1 OPERATOR TRAINING

.1 Provide training as appropriate for all equipment supplied as part of the Contract. As needed, scheduling of training is to be arranged with the Engineer. Training plan to be provided four (4) weeks in advance.

.2 The training will be by the Manufacturer's Representative and / or the Installer Trades and will include maintenance procedures, troubleshooting, and repair procedures for all electrical and mechanical components. Contractor to assist and coordinate operator training.

3.2 INSTALLATION

.1 General: Equipment shall be installed in accordance with the manufacturer's written recommendations.

.2 Alignment: Equipment shall be field tested to verify proper alignment.

3.3 PACKAGED EQUIPMENT

.1 When any system is furnished as pre-packaged equipment, the Contractor shall coordinate space and structural requirements, clearances, utility connections, signals, and outputs with subcontractors to avoid later change orders.

.2 If the packaged system has any additional features (as safety interlocks, etc.) other than required by the Contract Documents, the Contractor shall coordinate such features with the Engineer and provide material and labor necessary for a complete installation as required by the manufacturer.

3.4 FIELD ASSEMBLY

.1 Studs, cap screws, bolt and nuts used in field assembly shall be coated with Never Seize compound or equal.

3.5 WELDING

.1 Welds shall be cleaned of weld-slag, splatter, etc. to provide a smooth surface.

3.6 FIELD TESTS

.1 Where indicated by the individual equipment sections, equipment shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, or overheating of bearings or motor.

.2 The following field testing shall be conducted:

- .1 Start equipment, check, and operate the equipment over its entire operating range. Vibration level shall be within the amplitude limits as indicated or as recommended by the reference applicable standards.
- .2 Obtain concurrent readings of motor voltage, amperage, capacity, vibration, and bearing temperatures.
- .3 Operate equipment per Manufacturer instruction.

.3 The Engineer shall witness field-testing. The Contractor shall notify the Engineer of the test schedule 3 Days in advance.

.4 If any equipment fails to meet the test requirements, the equipment shall be modified and retested until it satisfies the requirement.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

.1 Installation, including the supply of anchor bolts, and testing of equipment supplied under other sections in Division 40.

1.2 RELATED WORK

.1 Section 01 65 00 – Equipment Installation and Operational Testing

.2 Section 01 66 20 – Commissioning and Hand-Over

.3 Section 40 05 00 – General Provisions

1.3 DEFINITIONS

.1 Testing: In this Division, testing shall be defined as the operation of a specific item of equipment under actual and / or simulated conditions for the purpose of ensuring the equipment satisfies its basic design criteria. Testing for both Owner supplied equipment and Contractor supplied equipment shall be conducted by the Contractor. All materials, labour, power and equipment required to conduct the tests shall be the Contractor's responsibility.

.2 Commissioning shall be defined as the operation of equipment systems under actual and / or simulated conditions for the purpose of ensuring the system performs its intended functions.

1.4 SUBMISSIONS

.1 The Contractor shall check all the Shop Drawings relative to the equipment and materials, dimensions, measurements, size of members, type of materials, controls, list of equipment being supplied, names of manufacturers, and other details and be satisfied that they are correct and conform to the requirements and intent of the Contract Documents.

PART 2 PRODUCTS

2.1 MOUNTING REQUIREMENTS

.1 Provide all supports, anchorage, and mounting of all equipment in accordance with the manufacturer's recommendations, the NBC and industry standard requirements, unless otherwise specified.

.2 Provide all elements required to resist the calculated forces described herein.

.3 Design anchorage for all equipment bases, supports, and foundations in accordance with NBC for Seismic Zone 1.

2.2 ANCHOR BOLTS

.1 All anchor bolts for permanently or intermittently submerged services shall be stainless steel.

.2 All other anchor bolts shall be galvanized, or cadmium plated.

.3 Anchor bolts shall be sized to suit the equipment manufacturers' requirements.

.4 The use of drilled expansion anchors for any equipment will not be allowed unless reviewed and accepted by the Engineer.

PART 3 EXECUTION

3.1 COORDINATION

.1 Coordinate the Work specified under this section with the Work of other sections to produce a complete and workmanlike job.

3.2 PREPARATION

.1 Before commencing installation of the Work, inspect and take field measurements and ensure that work carried out previously in the area is not prejudicial to the proper installation of the Work.

.2 Refer to the equipment Specifications for assistance in determining the form in which equipment is to be shipped and the extent of field assembly required.

.3 Schedule the visits to the site of the Manufacturer's Representative for the times and periods specified in other sections. Cooperate in supervision of the installation and start-up. Follow all reasonable instructions of the Manufacturer's Representative. Should the Contractor require the Manufacturer's Representative to attend for longer or more frequent periods, the Contractor shall arrange this, at no added cost to the Owner.

3.3 INSTALLATION OF EQUIPMENT

.1 All equipment as supplied by the Owner, as noted, or shown on the Drawings is to be installed by the Contractor.

.2 Dimensions shown in the Contract Documents for equipment bases, piping connections, etc., are approximate and must be corrected by the Contractor to suit the exact dimensions of the equipment provided for each application. Any necessary modifications to piping connections or to pipework shall be arranged by the Contractor at no added expense to the Owner and must be acceptable to the Engineer.

.3 Supply all necessary shims, gaskets, etc., and all necessary lifting and loading equipment and tools, etc., required to complete the installation.

.4 Where equipment is supplied with a plate steel base, provide access holes in the top of the plate, and use a pour grade, non-shrink, non-metallic grout to fill the entire void under the base.

.5 Prepare grout as specified in Division 3 and provide full contact with the equipment bases unless otherwise recommended by the equipment manufacturer and accepted by the Engineer. The grout shall be neatly beveled, formed or trimmed.

.6 Submit the proposed sequence of installation to the Engineer with the Shop Drawings.

.1 Demonstrate to the Owner, Engineer, and manufacturer the final alignment (hot or cold as applicable), no soft foot, and no pipe strain.

.2 Extend any inaccessible lubrication points and lubricant drains to convenient locations. Remove storage lubricant and provide the initial fill of new lubricants for the equipment. Lubricant grade to be as recommended by the manufacturer.

3.4 ALIGNMENT

.1 Set and align all rotating equipment in accordance with the manufacturer's requirements.

3.5 QUALITY ASSURANCE FORMS

.1 Test all process equipment to ensure it operates in accordance with the basic design criteria in the Specifications. The Contractor will be required to have a series of forms completed which attest to the proper installation and functioning of the equipment. Refer to Section 01 65 00 – Equipment Installation and Operational Testing for Form 101, Form 102 and Form 103 and Section 01 66 20 - Commissioning and Handover for Form 104 and Form 105.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section describes the pipe materials, fittings, appurtenances, installation and testing of the process systems.

.2 Provide the design of piping supports, pipe guides and anchors based upon final piping layout. Typical support details and structural attachments shown on the drawings indicate the level of quality that will be considered acceptable.

.3 Provide the necessary submittals and ensure the proper registration of piping systems and system components as required by the British Columbia Boilers Safety Association and British Columbia Safety Code.

1.2 DEFINITIONS

.1 Pressure terms used in this and other related sections are defined as follows:

- .1 Maximum pressure: The greatest continual pressure at which the piping system operates.
- .2 Test pressure: The hydrostatic pressure used to determine system compliance.

.2 Pipe and appurtenance location terms used in this and other related sections are defined as:

- .1 Pumphouse and Buildings: Within an environmentally controlled enclosure where temperature is maintained above 5°C.
- .2 Submerged: Regularly or occasionally immersed in liquid; inside tanks, and within 3.0 m above maximum water level of open tankage.
- .3 Underground (or buried): Placed in soil and not tied to structures.

1.3 REFERENCE STANDARDS

.1 Conform to the latest edition of the following reference standards:

- .1 ANSI A13.1, Scheme for the Identification of Piping Systems.
- .2 ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- .3 ANSI B16.5, Pipe Flanges and Flanged Fittings.
- .4 ANSI B16.15, Pipe Flanges and Flanged Fittings, Classes 150 and 300.
- .5 ASTM A105/A105M, Forgings, Carbon Steel, for Piping Components.
- .6 ASTM A126, Grey-Iron Castings for Valves, Flanges, and Pipe Fittings
- .7 ASTM D2241, Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- .8 ASTM D2996, Filament-Wound Reinforced Thermosetting Resin Pipe.
- .9 ASTM D5162-01 Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
- .10 AWWA C207, Steel Pipe Flanges for Waterworks Services - Sizes 4 Inch Through 144 Inch.

.11 AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.

.12 AWWA M11, Steel Pipe - A Guide for Design and Installation.

.13 CAN/CGA B149.1, Natural Gas and Propane Installation Code

.14 CPC, Canadian Plumbing Code.

.15 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code

.16 NPC, National Plumbing Code.

1.4 DESIGN REQUIREMENTS

.1 Process and Instrumentation drawings, piping schematics, and piping layout drawings are contained in the drawing set. The Process and Instrumentation Drawings (P&IDs) indicate all major pipework, valves, and appurtenances (other than cleanouts, purge points, etc.). The layout drawings indicate the Owner's Representative's concepts and are intended to illustrate a constructible method for the piping systems. Some appurtenances, supports, guides and anchors, and expansion joints are not fully shown. The Contractor's design will complement and detail these drawings.

.2 It is understood that some conflicts may arise that will require that the Contractor re-route some of his piping to allow for the installation of wiring, ventilation duct, or similar. Refer to the general requirements indicated for pipe locations, routing, and spacing.

.3 The Contractor is required to be responsible for the final aspects of the design. The components of the design that will be generated will be as follows:

.1 Piping support system design, including details and spacing of all supports. The support system will ensure that the weight of the pipework and commodities, and the need for lateral and vertical support are considered fully.

.4 Design documentation will be submitted to the Owner's Representative as necessary to indicate compliance with the requirements of the piping systems.

1.5 SUBMITTALS

.1 For each piping system referred to in Section 40 05 13, submit documentation listing pipe, fittings, flexible connectors, linings, coatings, and valving to be used for each pipe size and category.

.2 A copy of this specification section and all referenced sections with each paragraph check-marked to show compliance or highlighted to indicate deviation.

.3 Submit copies of all original submittals and all related correspondence made as part of the regulatory submission required by the British Columbia Safety Codes Act and British Columbia Boilers Safety Association for the Registration of Pressure Piping (where required), and any submissions required by other regulatory authorities.

.4 Product Samples: Where specified or when directed by the Owner's Representative, provide mill test results or product samples.

.5 Submit installation and testing reports in accordance with the British Columbia Safety Codes Act and British Columbia Boilers Safety Association.

1.6 COORDINATION

.1 Process and Utility Piping Identification

.1 Refer to the front-end documents for process piping identification.

.2 Process and utility piping are identified in the drawings by a three component alpha-numeric code, (Line Label) as follows:

.1 The first component of the code indicates the process fluid being conveyed, (Commodity). The process fluid (Commodity) codes are defined in the drawings

.2 The second item is the nominal pipe diameter in mm.

.3 The third item is the pipe material specification.

.3 Detailed pipe specifications are provided for each pipe specification code in Section 40 05 13.

.4 Routing: Coordinate piping installation routes and elevations with installation of sheet metal, instrumentation, and electrical work.

.5 Pipe Penetrations: Coordinate with other divisions, prior to construction, to locate and place sleeves, flanged nozzles, etc as required to run the piping as shown on the Drawings.

1.7 COORDINATION WITH OTHER CONTRACTS

.1 Be responsible for the coordination, scheduling, and timely completion of work at the interface between this Contract and other contracts by coordinating and cooperating with other contractors.

.2 This Contract will be required to make a number of connections to existing systems. Contractor must test all of its utilities according to the relevant piping specifications prior to making these connections.

1.8 QUALITY ASSURANCE

.1 Regulatory Submissions

.1 Complete all regulatory submissions as required by the British Columbia Safety Codes and British Columbia Boilers Safety Association for the Registration of Pressure Piping Design (where required).

.2 Complete all other submissions as required by other regulatory authorities.

1.9 CONFLICTS

.1 Review the drawings prior to installation of piping, conduit services, and fixtures by this or any other division. Identify any conflicts and cooperate with the Owner's Representative to determine the adjustments necessary to resolve these conflicts.

.2 Confirm the routing of each section of pipework with other services prior to commencement of installation. Advise the Owner's Representative of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict and confirm with the Owner's Representative.

1.10 SHIPMENT, PROTECTION AND STORAGE

.1 Deliver pipe, fittings and appurtenances to site using loading methods which do not damage pipe or coatings.

.2 Piping materials delivered to site will be clearly marked to indicate size, type, class/schedule, and coatings.

.3 Until ready for incorporation in the work, store on site as recommended by the piping materials manufacturer to prevent damage, undue stresses, or weathering.

.4 Store materials at least 200 mm above ground with sufficient supports to prevent undue bending.

.5 Protect non-UV light inhibited plastic from sunlight.

PART 2 PRODUCTS

2.1 FUNCTION

.1 Provide the pipe materials, fittings, and appurtenances as described below, for the piping systems shown.

2.2 PIPE MATERIALS – GENERAL

.1 All pipe materials to be new, free from defects and conforming to the reference standards identified in Section 40 05 13.

2.3 PIPE SIZES

.1 Where the pipe size is not specified, provide pipe with the sizes required by the British Columbia Plumbing Code. For small piping not described by the British Columbia Plumbing Code, use 20 mm nominal diameter.

2.4 FITTINGS

.1 General

.1 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise.

.2 Provide concentric reducers in vertical lines unless indicated otherwise.

.3 Provide long radius elbows unless otherwise shown.

.2 Copper Pipelines: Provide copper fittings conforming to ANSI B16.26.

2.5 GASKETS

.1 For flat faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets. Conform to ANSI B16.21.

.2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosivity of the fluid conveyed in the pipeline. Ensure that gasket material is non-reactive with pipe material. Refer to the detailed pipe specification sheets for the recommended gasket material. Material designations used in the detailed pipe specification sheets are as follows:

.1 EPDM: Ethylene-propylene-diene-terpolymer 70 durometer.

.2 White Neoprene: Neoprene 70 durometer, Food Grade.

.3 Nitrile: Nitrile (Buna N).

.4 SBR: Styrene-butadiene (red).

.5 Natural rubber: Natural rubber.

.6 Compressed synthetic fibers (Kevlar): ASTM F104 (F712400), and neoprene binder: 1.7 MPa (ASTM F152), 0.2 mL/h Leakage Fuel A (ASTM F37).

.7 Compressed synthetic fibers (Kevlar): ASTM F104 (F712400) and SBR binder: 1.7 MPa (ASTM F152). 0.1 mL/h Leakage Fuel A (ASTM F37).

.8 Gylon - Type 1: Garlock Style 3500. 1.35 MPa (ASTM F152). 0.22 mL/h Leakage Fuel A (ASTM F37).

.9 Gylon - Type 2: Garlock Style 3510. 1.35 MPa (ASTM F152). 0.04 mL/h Leakage Fuel A (ASTM F37).

.10 CPE - Chlorinated Polyethylene.

.3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:

.1 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.

2.6 BOLTS AND NUTS

.1 Provide hex head bolts and nuts. Threads to be ANSI B1.20.1, standard coarse thread series.

.2 For general service, use bolts and nuts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Gr.A.

.3 Provide stainless steel bolts, nuts, and washers for submerged, buried, and concrete encased service; bolts conforming to ASTM A193, Gr.B8, C1.1; nuts conforming to ASTM A194, Gr.8.

.4 Provide stainless steel 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 nuts.

2.7 GROUT

.1 Non-shrink grout: Conform to Division 3.

2.8 CONCRETE

.1 Provide concrete for concrete surround placed around buried pipe, and fill placed over buried pipe, in accordance with Division 3.

PART 3 EXECUTION

3.1 PREPARATION

.1 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

.2 Make all minor alignment and location modifications to suit installed equipment and structural element locations and elevations.

.3 Piping arrangements indicated on the drawings have been established on the basis of the “Design Standard” listed in the specific process equipment sections. If the equipment differs from that shown, at no additional expense to the Owner, modify the piping arrangement to suit.

.4 Advise the Owner’s Representative of all modifications. Do not commence work on the related piping until all modifications have been reviewed by the Owner’s Representative.

.5 Include any piping modifications in the shop drawings submitted prior to fabrication or installation.

3.2 PIPE HANDLING

.1 Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings.

.2 Remove all foreign matter from inside of pipe prior to installation.

.3 Repair pipe with damaged protective coatings with material similar to the original in accordance with the manufacturer's directions and to the satisfaction of the Owner / Owner’s Representative.

.4 Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.

.5 Avoid lifting internally with hooks, forks, or chains at any time.

3.3 INSTALLATION

.1 Fabricate and install pressure piping in interior building spaces in accordance with the ASME pressure vessel code and the British Columbia Boilers Safety Association, British

Columbia Safety Act and Regulations. Fabricate and install domestic water piping in accordance with the British Columbia Plumbing Code.

.2 The Contractor is responsible for the design, supply, and installation of the piping system in general accordance with the indicated requirements.

.3 Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage. Supports, bracing, and expansion joints shown in the drawings are schematic only. The Contractor is responsible for the design, supply, and installation.

.4 Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag, or stress.

.5 Do not support pipe on masonry block construction without prior approval of the Owner's Representative.

.6 Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves, or pipe.

.7 Accurately cut all piping for fabrication to field measurements.

.8 Install pipes in straight alignment. Do not exceed 10 mm in 10 m variance from the true alignment, in any direction. Fabricate and assemble pipe runs so that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment is not permitted. Undo and subsequently remake all pipework connections to ensure that springing does not occur. Take care not to damage equipment, valves, or flanges.

.9 Do not cut or weaken the building structure to facilitate installation.

3.4 TESTING

.1 Give the Owner's Representative 24 hours' notice prior to testing.

.2 Do not conceal work until piping systems are tested and accepted.

.3 Supply all water and air required for pressure testing.

.4 Supply all pumps, compressors, gauges, etc. of adequate size, performance range, and accuracy to meet the testing requirements.

.5 Install air threadolets, air relief valves and line fitting valves as necessary to complete testing. Remove after testing and plug the threadolets.

.6 Cap or plug all lines which are normally open ended. Remove on completion of testing.

.7 Provide all temporary thrust restraints necessary for testing. Remove upon completion of testing.

.8 Test all underground lines prior to backfilling. Do not place concrete surround until lines are tested.

.9 Test all existing piping where it connects to new piping to the first valve in the existing piping. Repair any failures in existing piping which occur as a result of the test after informing the Owner's Representative of such failure.

.10 Isolate all low pressure equipment and appurtenances during testing so as not to place any excess pressure on the operating equipment.

.11 Where defective material or equipment is identified, repair or replace using new material.

.12 Flush and drain liquid pipes after pressure tests. Purge all gas pipes after pressure tests.

.13 Dispose of flushing water in manner approved by the Owner / Owner's Representative, which causes no damage to buildings or siteworks.

3.5 PRESSURE TESTING OF LIQUID LINES

.1 Hydrostatically test all lines normally used for the conveyance of liquid using water as the test medium.

.2 Test pressures and durations shall be as specified in the detailed specification sheets.

.3 Ensure all lines are filled with water. Bleed air from all high spots using the taps provided specifically for that purpose.

.4 Zero leakage is permitted throughout the specified test period for all exposed piping, buried insulated piping, and any liquid chemical lines.

.5 Show evidence of leakage rates below 0.01 litre per hour per mm pipe diameter per 100 m of pipe length for buried piping, unless otherwise specified.

.6 Test drains in accordance with the British Columbia Plumbing Code.

3.6 CLEANING AND FLUSHING

.1 After installation and prior to testing, perform initial cleaning of process and utility lines. Give lines smaller or equal to 150 mm an initial flush or purge.

.2 After initial cleaning, connect the piping systems to related process equipment. Insert temporary screens, provided with visible locator tabs, in the suction of pumps and compressors in accordance with the following table:

Suction Diameter, mm	Maximum Screen Opening, mm
0 - 25	1.5
30 - 75	6.25
80 - 150	12.5
>150	25

.3 Maintain the screens during testing, flushing/purging, initial startup, and the initial operating phases of the commissioning process. In special cases and with the Owner / Owner's Representative's acceptance, screens may be removed for performance tests.

.4 Unless specified otherwise, flush liquid systems after testing, with clean water and screens in place. Maintain flushing for a minimum period of 15 minutes and until no debris is collected in the screens.

.5 In air or gas systems with pipe sizes less than or equal to 150 mm, purge with air and/or inert gases before testing. Upon completion of testing and cleaning, drain and dry the piping with a dry air stream. Satisfy ANSI/ISA-S7.3 standards for instrument air systems.

.6 Brush clean steel pipe exterior to SSPC-P3 standard prior to painting. Also refer to Division 9.

3.7 DISINFECTION

.1 Disinfect lines intended for potable water service after testing in accordance with AWWA C651.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

.1 Supply and installation of hangers and supports for all piping systems specified in Section 40 05 13 – Process Piping Systems, and 40 05 15 – Process Piping This section does not include pipe support for fire sprinkling systems where applicable, pipe anchors, guides, or seismic restraints.

1.2 RELATED WORK

.1 General Provisions: Section 40 05 00

.2 Process Equipment Installation: Section 40 05 01

.3 Process Piping Systems: Section 40 05 13

.4 Chemical Piping Systems: Section 40 05 15

1.3 SUBMISSIONS

.1 Submit the following for information in accordance with Section –01 33 00 – Submittals:

.1 In piping layout drawings, indicate hanger and support locations and provide legend summarizes load information and hanger and support component selection at each location.

.2 Seismic restrain design of the piping system.

1.4 SERVICE CONDITIONS

.1 The intent of the Drawings has been to indicate general arrangements and typical spacings for pipe systems but does not relieve the Contractor of the responsibility for the design and supply of a complete and adequate support system.

.2 Provide hangers and supports specified in this Section to resist pipe loads occurring primarily in the downward (gravity) direction.

1.5 HANGER AND SUPPORT SELECTION

.1 Select pipe hangers and supports as specified in this section.

.2 Review the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the type of support to be used at each hanger point.

.3 Hangers and supports shall withstand all static and specified dynamic conditions of loading to which the piping and associated equipment may be subjected. As a minimum, consideration shall be given to following conditions:

.1 Weights of pipe, valves, fitting, insulating materials, suspended hanger components, and normal fluid contents.

.2 Weight of hydrostatic test fluid or cleaning fluid if normal operating fluid contents are lighter.

.3 Reaction forces due to the operation of safety or relief valves.

.4 Wind, snow, or ice loadings on outdoor piping.

.4 Size hangers and supports to fit the outside diameter of pipe, tubing, or where specified, the outside diameter of insulation.

.5 Where negligible movement occurs at hanger locations, use rod hangers for suspended lines, whenever practical. Use bases, brackets or structural cross members for piping supported from below.

.6 Hangers for the suspension of pipe and tubing sizes, 65mm and larger shall be capable of vertical hanger component adjustment under load.

.7 Provide the supporting systems to allow for free or intended movement of the piping including its movement in relation to that of connected equipment.

.8 Design the system to support the operating loads with a safety factor of 4.0.

.9 Where there is horizontal movement at a suspended type hanger location, select hanger components to allow for swing. The vertical angle of the hanger rod shall not, at any time, exceed 4 degrees.

.10 No contact is allowed between a pipe and hanger or support components of dissimilar metals. Prevent contact between dissimilar metals when supporting copper tubing with copper-plated, rubber, plastic or vinyl coated, or stainless steel hanger and support components.

.11 Do not attach pipe support components to equipment or pressure vessels unless otherwise specified.

.12 Use stock hanger and support components wherever practical.

.13 Provide supplementary structural members, where structural bearings are not in suitable locations.

.14 Make provision for expansion, contraction, slope, and anchorage.

.15 Where necessary, pipe support systems shall withstand the additional load of electrical or instrumentation trays. Coordinate with other divisions. Design and provide support system accordingly.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 The following manufacturer's products to provide the specified features and to meet specified operating conditions:

.1 B-Line

.2 Grinnell
.3 Powerstrut
.4 Superstrut
.5 Unistrut

2.2 MATERIALS

.1 Unless otherwise specified, pipe hangers and supports, structural attachments, fittings and accessories are hot-dipped galvanized after fabrication. Provide AISI, Type 304 stainless steel nuts, bolts, washers, threaded rod, and concrete inserts.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT LOCATION

.1 Locate hangers and supports as near as possible to concentrated loads such as valve, flanges, etc. Locate hangers, supports and accessories within the maximum span lengths to support continuous pipeline runs unaffected by concentrated loads.

.2 Provide hangers and/or base supports within one meter of each change in direction on each leg, on one side of each valve, and on the first spool piece or fitting extending from a piece of equipment.

.3 Locate hangers and supports to ensure that connections to equipment, tanks, etc. are substantially free from loads transmitted by the piping.

.4 Ensure that where piping is connected to equipment, a valve, piping assembly etc. that will require removal for maintenance, the piping will be supported in such a manner that temporary supports will not be necessary for this procedure.

.5 Support piping so that no pockets will be formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves, and fittings.

3.2 INSTALLATION

.1 Do not use hanger components for purposes other than for which they were designed. Do not use hanger components for rigging and erection purposes.

.2 Install items to be embedded before concrete is poured. Fasten embedded items security to prevent movement when concrete is poured.

.3 Aluminum or galvanized steel clips shall be used to support piping from aluminum or steel structural members. Where metals of different type are to be connected, provide isolation to prevent galvanic corrosion.

.4 Use embedded anchor bolts instead of concrete inserts for support installation in areas below water surface or normally subjected to submerging.

.5 All minor modifications to accommodate installed equipment and structural components are subject to review. Do not commence work on related piping until written acceptance has been received.

.6 Include any piping support modifications on the Shop Drawings submitted prior to fabrication or installation.

.7 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

.8 Hanger and support components in contact with plastic pipe shall be free of burrs and sharp edges.

.9 Rollers shall roll freely without binding.

.10 Finished floor beneath Type L structural attachments and framing channel post bases shall be roughed prior to grouting. Grout between base plate and floor shall be free of void sand foreign material.

.11 Provide plastic or rubber end caps at the exposed ends of all framing channels that are located up to 2100mm above the floor.

.12 Review the Drawings prior to installation of piping, conduit, and fixtures by this or any other division. Identify any conflicts and confirm the routing of each section of pipe work prior to commencement of installation. Advise of any conflicts with existing services. Where necessary, amend the routing of pipework to avoid conflict and provide Shop Drawings showing proposed routing.

3.3 ADJUSTMENT

.1 Adjust hangers and supports to obtain required pipe slope and elevation. Use shims made of material that is compatible with the piping material. Adjust stanchions prior to grouting of baseplates.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section specifies the supply, installation and testing of sludge system and polymer system piping including valves, fittings, and appurtenances as necessary and as shown on the drawings.

.2 Conform to Division 1 - General Requirements.

1.2 SEISMIC DESIGN AND ANCHORAGE

.1 All components of the piping system shall be designed as a post disaster structure to resist and be connected to the structure for seismic loads as specified in the British Columbia Building Code (BCBC 2012). For calculating the seismic load, site-specific data, refer to BCBC 2012 and Structural Design Notes.

1.3 SUBMITTALS

.1 Submit under provisions of Section 01 33 00 – Submittals.

.2 Shop Drawings and Product Data:

- .1 Material Specification data for pipe, fittings, and accessories.
- .2 Pipe layout drawings or Schedule.
- .3 Installation instructions.
- .4 Fitting dimensions.

.3 Seismic Restraint Design and Calculation signed and sealed by a structural Professional Engineer (P.Eng.) registered in British Columbia – if required

.4 Seismic Restraint Product Data – if required

.5 Test Reports: Reports of field tests.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

.1 PVC Piping:

- .1 Piping shall be Polyvinyl Chloride (PVC), Schedule 40, Normal Impact, ASTM D1785.
- .2 Fitting shall be PVC, Schedule 40, Normal Impact, Socket Weld, ASTM D2467.
- .3 Solvent Cement shall be CPVC, IPS Weld-On 724, ASTM D2855.

2.2 BALL VALVES

.1 The ball valves shall meet the following criteria:

.1 Accepted materials are PVC, PTFE, Viton.

.2 Materials shall be compatible with pipe material.

.3 Joints for valves 2” and smaller shall be Unions (true-union valves). Joints for valves 3” and larger shall be flanged.

2.3 STATIC MIXERS

.1 Provide one static mixer as required for sludge system.

.2 Material of construction: PVC

.3 Diameter:

.1 150 mm

.4 The static mixer should be of non-ragging type (also called non-blocking or non-clogging) and specifically designed for wastewater sludge mixing

.5 Acceptable products are:

.1 Saf.T.Flo as supplied by Cleartech

.2 Koflo sludge mixers

.3 Approved equal.

.6 The manufacturer shall be Cleartech, Koflo corporation or approved equal.

2.4 CHECK VALVES

.1 All chemical solution line check valves 80 mm and smaller shall be 1050 kPa ball type, thermoplastic PVC with Viton seals, socket type, Chemline or approved alternative.

2.5 PIPE SUPPORT

.1 Pipe supports shall be Unistrut-style (posts, bases, and clips)

.2 Accepted material: FRP

.3 Accepted manufacturer: B-Line

.4 Refer to Section 40 05 14 for more details.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install all piping and equipment as specified in Sections 40 05 00 – General Provisions, Section 40 05 01 – Process Equipment Installation, Section 40 05 14 – Pipe Hangers and Supports, and Manufacturer recommendation.

.2 Provide seismic restrain calculation and installation at all process and chemical piping system per NBC and BCBC requirement.

3.2 FIELD QUALITY CONTROL

.1 Leakage:

.1 All joints shall be watertight and free of leaks.

.2 Pressure Test:

.1 AWWA C600, Section 4 and as follows:

.1 Subject all lines to a minimum hydrostatic pressure test of 50 psi or as otherwise indicated. Pressure test at 150 percent of working pressure or the pipe rated pressure. Conduct the test with the trench partially backfilled and the joints exposed to adequately prevent movement in the pipeline.

.2 Maintain test pressure for at least 120 minutes while line is inspected.

.3 Provide all necessary pumping equipment, piping connections, pressure gauges, and other required equipment, facilities, and materials.

.4 Immediately replace all pipe fittings, valves, pipe joints, and other materials found to be defective with new and acceptable material.

END OF SECTION

WWTP UPGRADES 2020
ISSUED FOR TENDER 2020.07.07

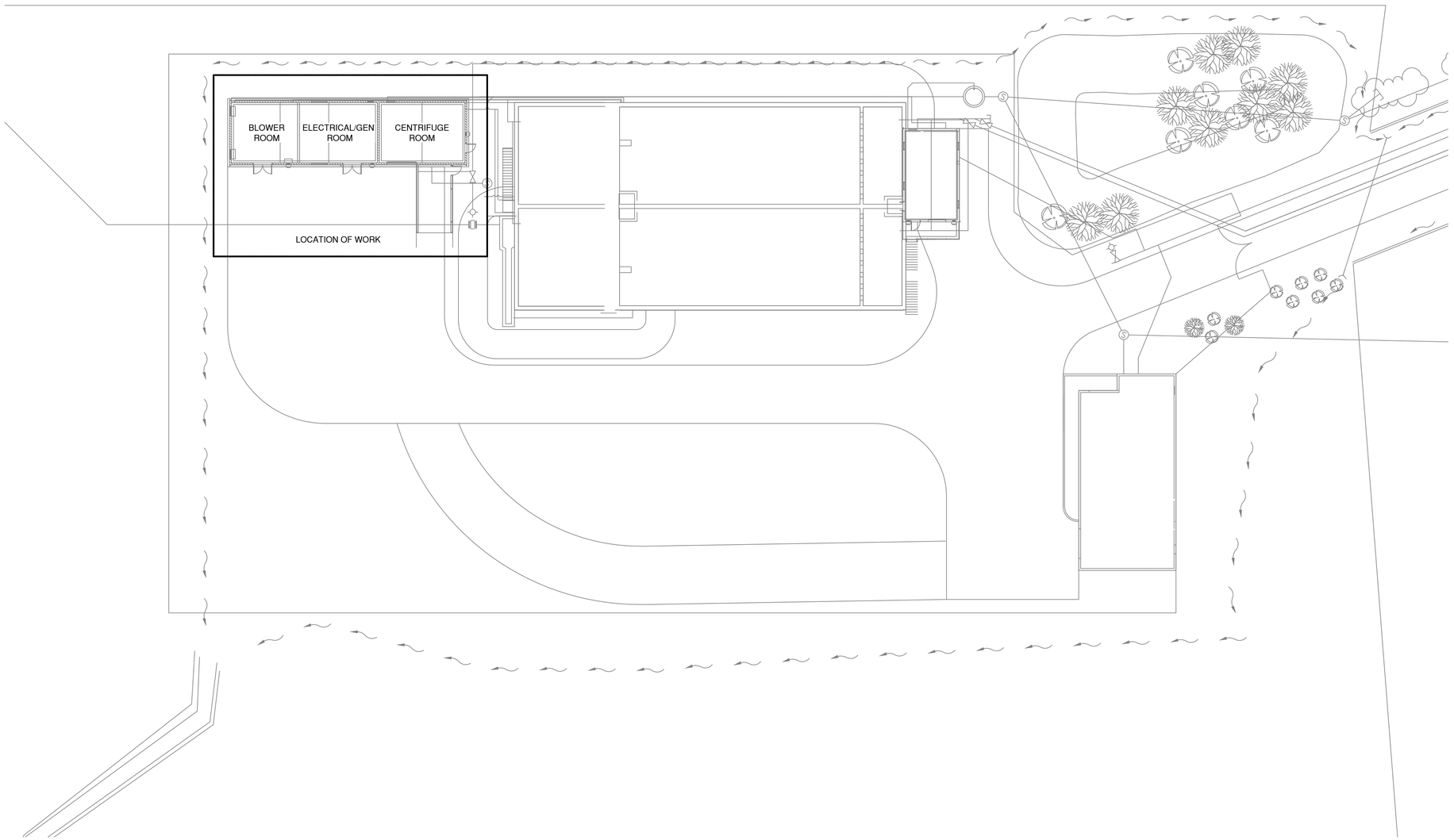
DRAWING LIST	
G-000	LOCATION PLAN AND DRAWING LIST
G-001	SITE PLAN
P-600	PROCESS REMOVALS
P-601	PROCESS PLAN VIEW
P-602	PROCESS SECTION A
P-603	PROCESS SECTION B
P-604	PROCESS SECTION C AND SECTION D
P-605	PROCESS FLOW DIAGRAM
A-100	ARCHITECTURAL SPECIFICATIONS
A-101	CANOPY PLAN AND ROOF PLAN
A-102	CANOPY SECTIONS
S-101	GENERAL STRUCTURAL NOTES AND DETAILS
E-001	CENTRIFUGE & ELECTRICAL ROOM LAYOUT
E-601	SINGLE LINE DIAGRAM & MCC LAYOUT
EI-650	BLOCK DIAGRAM

PROJECT LOCATION PLAN
SCALE: NTS

PROJECT NUMBER: 111720015
CONTRACT NUMBER 1790 -20/2020 WWTP - XXX

District of Sooke
2205 Otter Point Road
Sooke, BC V9Z 1J2

Stantec Consulting Ltd.
400 655 Tyee Road
Victoria BC Canada
V9A 6X5
Tel. 250.388.9161
Fax. 250.382.0514
www.stantec.com



LEGEND:

SCOPE OF WORK

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	RPH	SAL	2020.07.07
Issued	By	Appd	YYYY.MM.DD

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: G-001 | Dwn. RPH | Dsgn. | Chkd. | YYYY.MM.DD

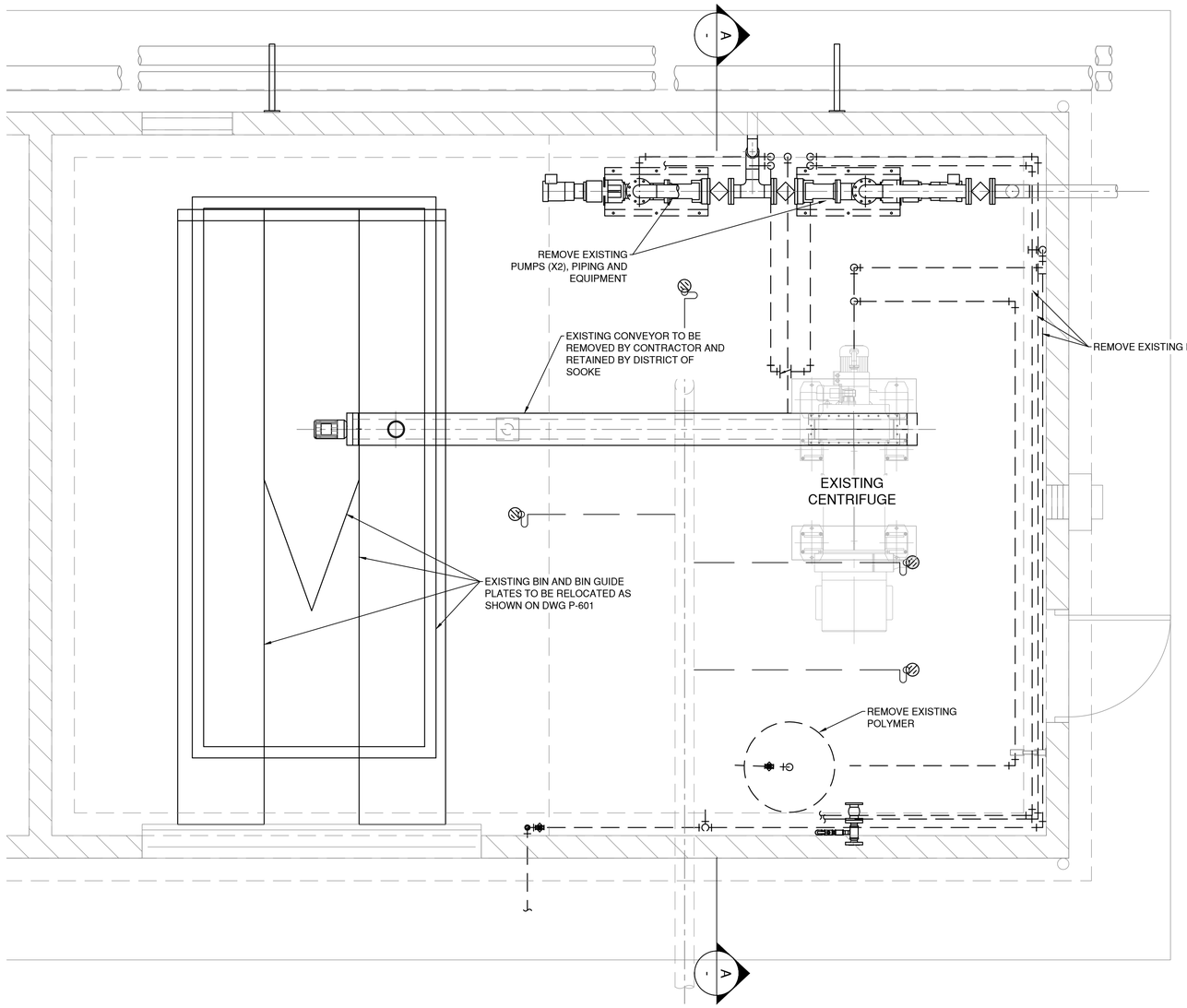
Title
SITE PLAN

Project No. 111720015

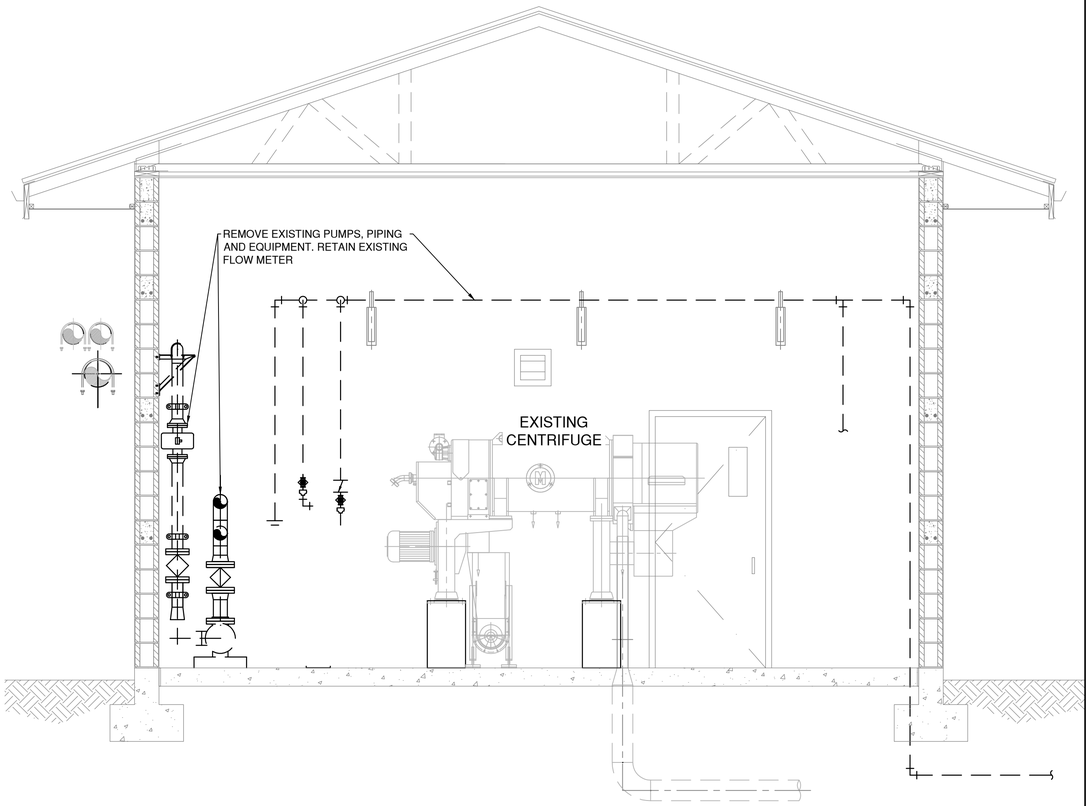
Scale 1:250

Revision | Sheet of

Drawing No. **G-001**



1 PLAN
SCALE: 1:25



A SECTION
SCALE: 1:25

1:25 0 0.25 0.75 1.25m

Revision	By	Appd	YYYY.MM.DD
3 FOR TENDER	TG	SS	2020.07.07
2 CLIENT REVIEW	TG	SS	2020.02.13
1 PRELIMINARY DESIGN REVIEW	TG	SS	2019.12.18

Issued

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

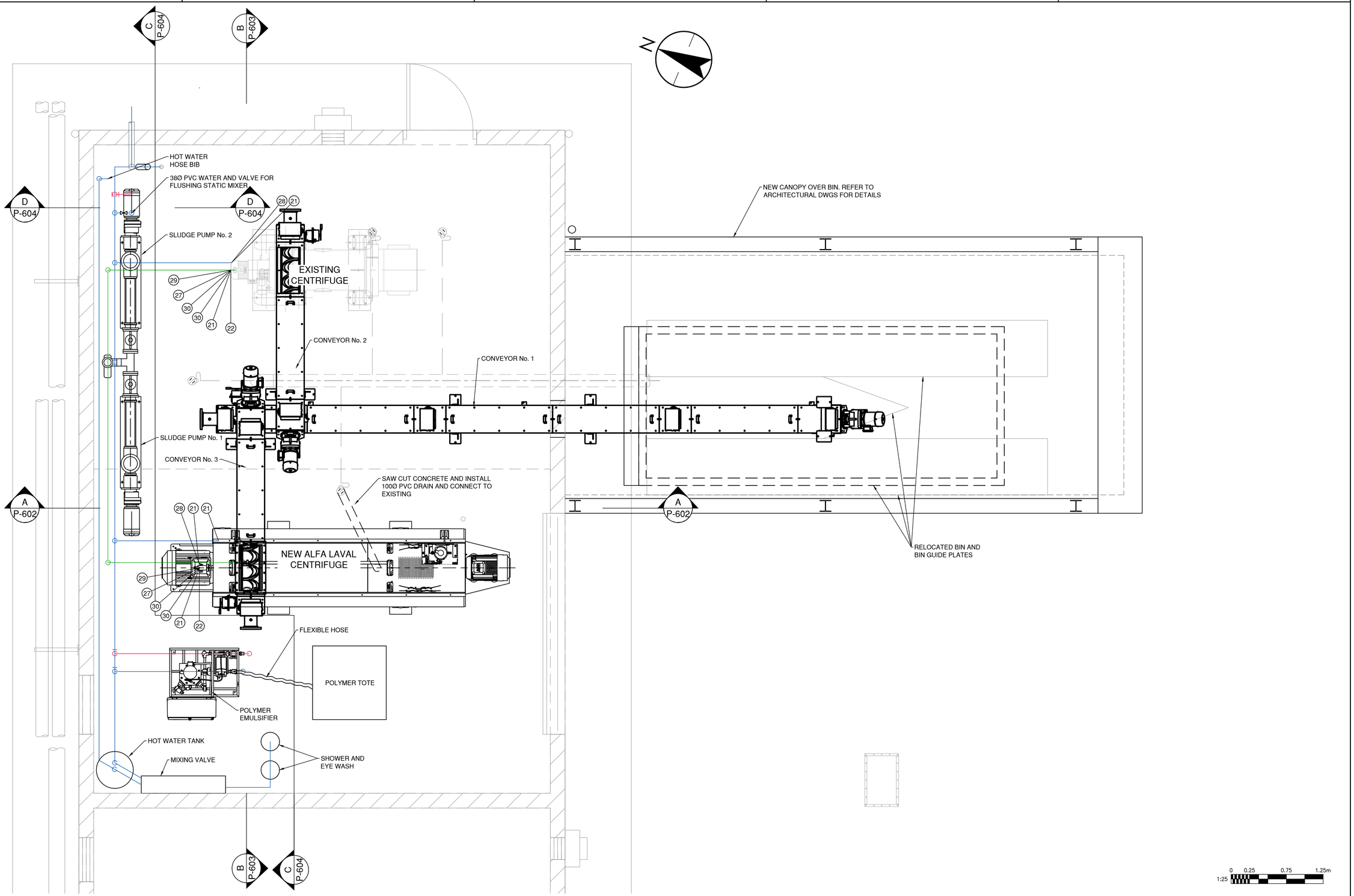
Sooke BC

File Name: 20015_P600_REMOVALS | TG Dwn. | SS / NT Dsgn. | SS Chkd. | YYYY.MM.DD

Title
PROCESS REMOVALS

Project No. 111720015
Scale 1:25
Revision
Sheet of
Drawing No. P-600

ORIGINAL SHEET - ISO A1



Revision	By	Appd	YYYY.MM.DD
3 FOR TENDER	TG	SS	2020.07.07
2 CLIENT REVIEW	TG	SS	2020.02.13
1 PRELIMINARY DESIGN REVIEW	TG	SS	2019.12.18

Issued

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project

District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 20015_P601_P604 | TG Dwn. | SS / NT Dsgn. | SS Chkd. | YYYY.MM.DD

Title

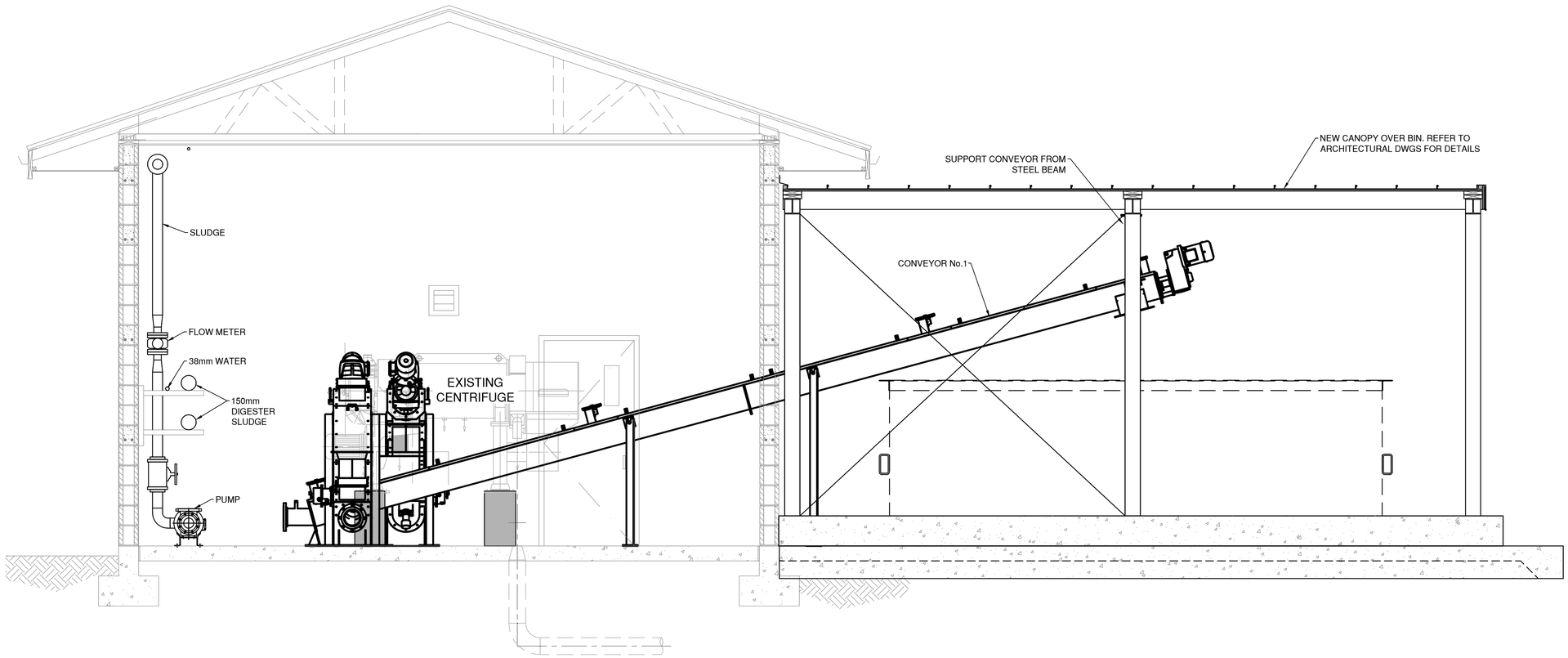
PROCESS PLAN VIEW

Project No. 111720015

Scale 1:25

Revision | Sheet of

Drawing No. **P-601**



A
P-601
SECTION
SCALE: 1:25

0 0.25 0.75 1.25m
1:25

Revision	By	Appd	YYYY.MM.DD
Issued			
3 FOR TENDER	TG	SS	2020.07.07
2 CLIENT REVIEW	TG	SS	2020.02.13
1 PRELIMINARY DESIGN REVIEW	TG	SS	2019.12.18

Permit/Seal

Consultant

Stantec
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

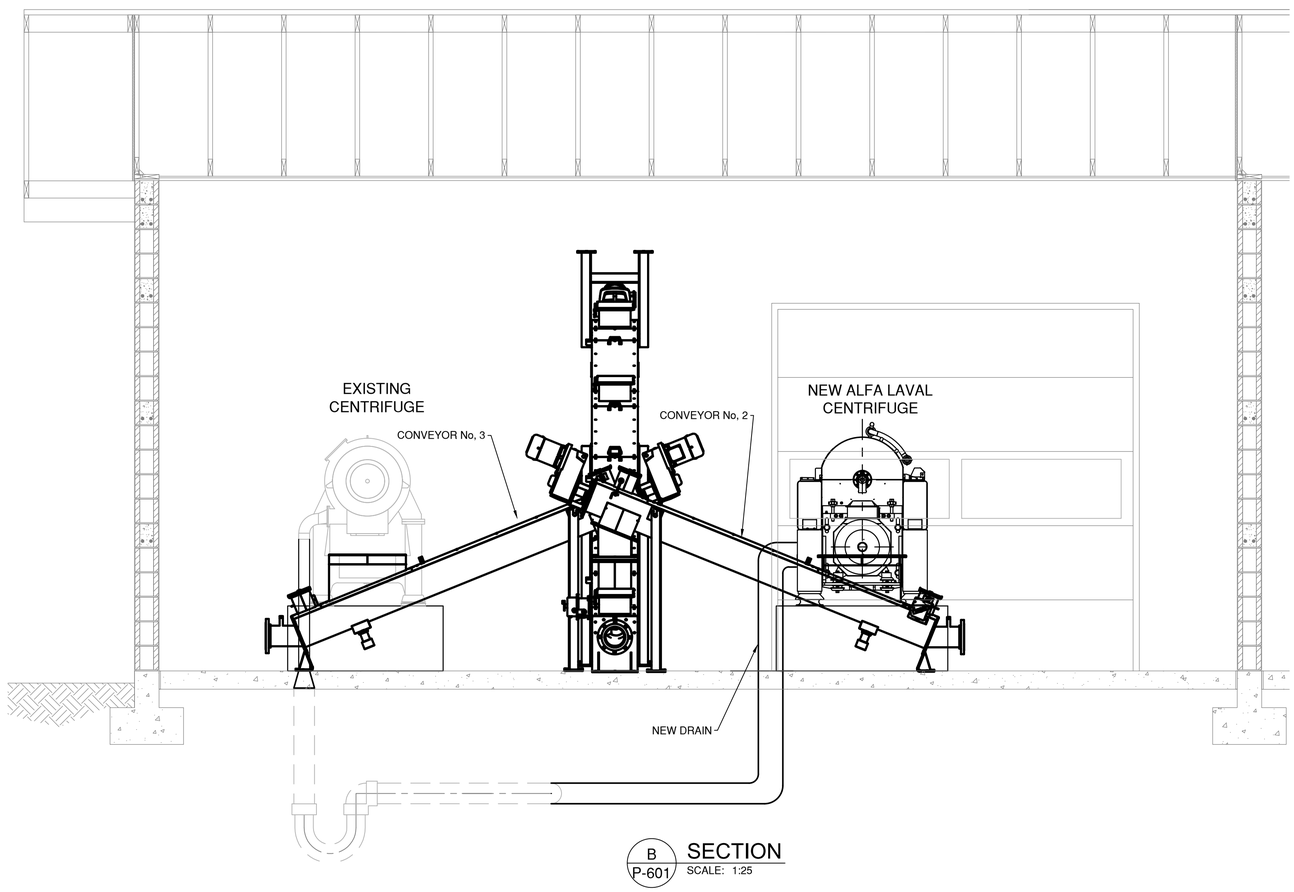
WWTP UPGRADES 2020

Sooke BC

File Name: 20015_P601_P604 | TG Dwn. | SS / NT Dsgn. | SS Chkd. | YYYY.MM.DD

Title
PROCESS SECTION A

Project No. 111720015
Scale 1:25
Revision
Sheet of
Drawing No. P-602



B P-601 SECTION
SCALE: 1:25

1:25 0 0.25 0.75 1.25m

Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
3 FOR TENDER	TG	SS	2020.07.07
2 CLIENT REVIEW	TG	SS	2020.02.13
1 PRELIMINARY DESIGN REVIEW	TG	SS	2019.12.18

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

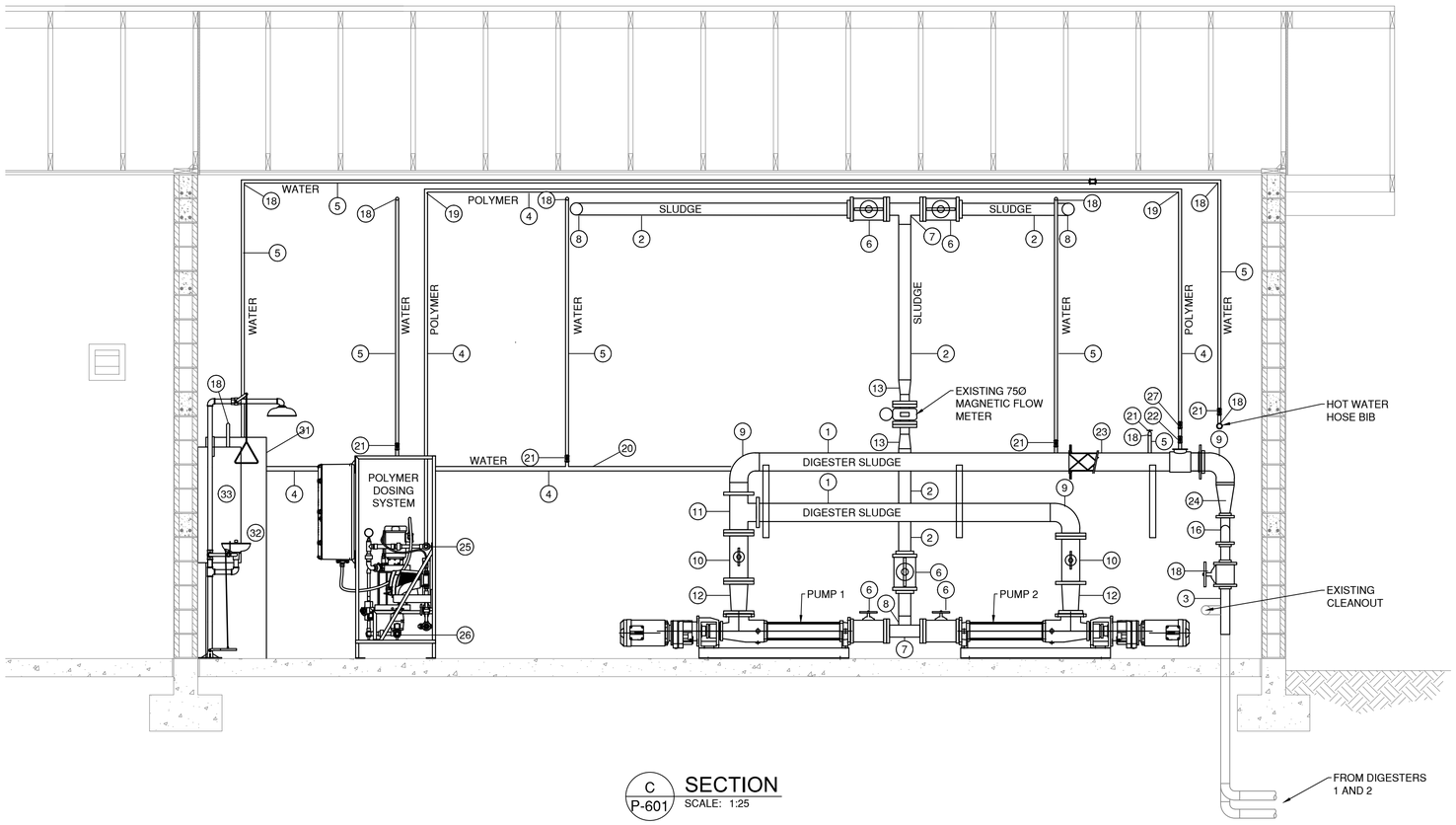
WWTP UPGRADES 2020

Sooke BC

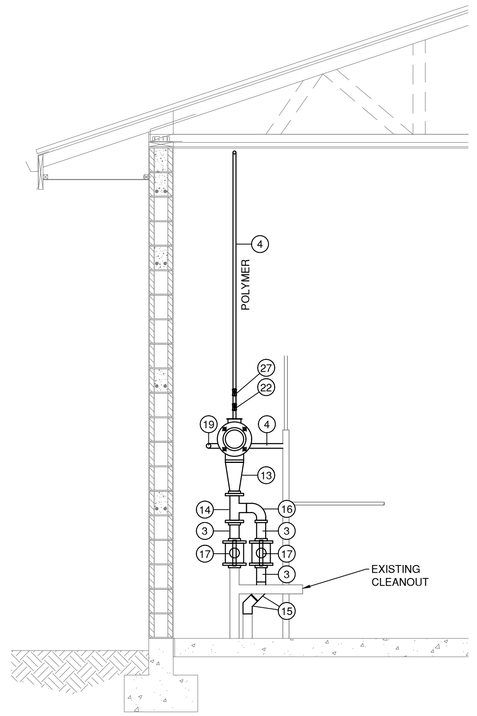
File Name: 20015_P601_P604 | TG Dwn. | Dsgn. | SS Chkd. | YYYY.MM.DD

Title
PROCESS SECTION B

Project No. 111720015
Scale 1:25
Revision
Sheet of
Drawing No. P-603



C P-601 SECTION
SCALE: 1:25



D P-601 SECTION
SCALE: 1:25

PUMPHOUSE ADDITION BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
1	AS SHOWN	150mm PVC PIPE
2	AS SHOWN	100mm PVC PIPE
3	AS SHOWN	75mm PVC PIPE
4	AS SHOWN	38mm PVC PIPE
5	AS SHOWN	25mm PVC PIPE
6	5	100mm PVC BALL VALVE
7	2	100mm X 100mm X 100mm PVC TEE
8	9	100mm PVC 90° BEND
9	3	150mm PVC 90° BEND
10	2	150mm PVC BALL VALVE
11	1	150mm X 150mm X 150mm PVC TEE
12	2	150mm X 125mm PVC REDUCER
13	2	100mm X 75mm PVC REDUCER
14	1	75mm X 75mm X 75mm PVC TEE
15	2	75mm PVC 45° BEND
16	1	75mm PVC 90° BEND
17	2	75mm PVC BALL VALVE

PUMPHOUSE ADDITION BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
18	23	25mm PVC 90° BEND
19	5	38mm PVC 90° BEND
20	3	38mm X 38mm X 25mm PVC TEE
21	10	25mm PVC BALL VALVE
22	3	38mm PVC BALL VALVE
23	1	150mm PVC STATIC MIXER
24	1	150mm X 75mm PVC REDUCER
25	1	38mm X 19mm PVC REDUCER
26	1	25mm X 19mm PVC REDUCER
27	3	38mm PVC CHECK VALVE
28	2	25mm PVC CHECK VALVE
29	2	100mm X 63.5mm PVC REDUCER
30	4	63.5mm X 25mm X 63.5mm PVC TEE
31	1	300 L HOT WATER TANK
32	1	EMERGENCY SHOWER AND EYE WASH STATION
33	1	TEMPERATURE CONTROL MIXING VALVE

NOTES:

1. ALL FITTINGS TO BE SOCKETED SCH 40 PVC.
2. ALL PIPING TO BE SCH 40 PVC.
3. VAN STONE FLANGES TO BE 150# PVC, SUPPLIED WITH GASKET AND SS BOLT-UP KIT.
4. ALL GASKETS TO BE 3mm GARLOCK 22 RED SBR RUBBER

0 0.25 0.75 1.25m
1:25

Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
3 FOR TENDER	TG	SS	2020.07.07
2 CLIENT REVIEW	TG	SS	2020.02.13
1 PRELIMINARY DESIGN REVIEW	TG	SS	2019.12.18

Permit/Seal

Consultant

Stantec
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

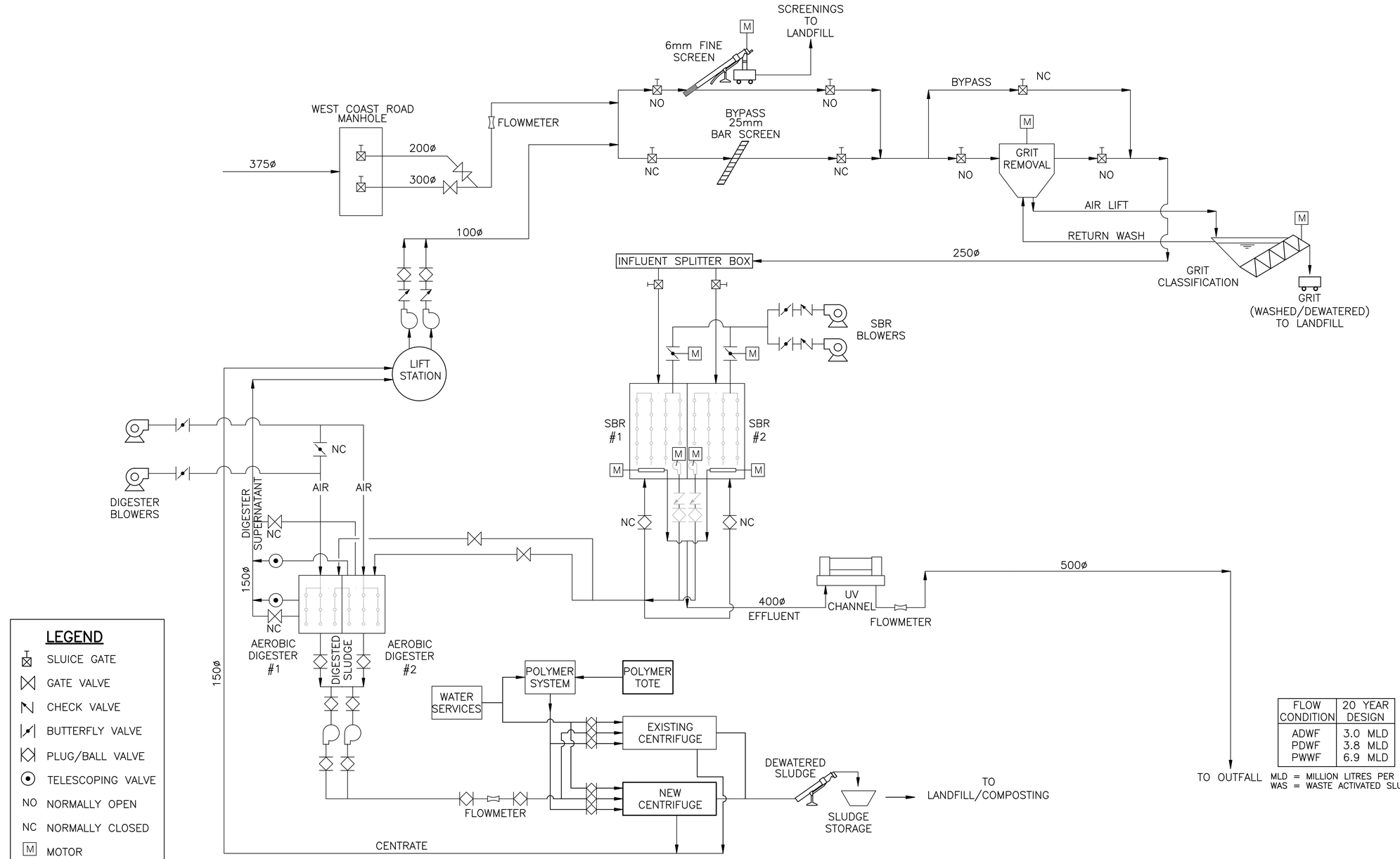
WWTP UPGRADES 2020

Sooke BC

File Name: 20015_P601_P604 | TG Dwn. | Dsgn. | SS Chkd. | YYYY.MM.DD

Title
PROCESS SECTION C AND SECTION D

Project No. 111720015
Scale 1:25
Revision
Sheet of
Drawing No. P-604



FLOW CONDITION	20 YEAR DESIGN
ADWF	3.0 MLD
PDWF	3.8 MLD
PWWF	6.9 MLD

MLD = MILLION LITRES PER DAY
WAS = WASTE ACTIVATED SLUDGE

LEGEND

- SLUICE GATE
- GATE VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- PLUG/BALL VALVE
- TELESCOPING VALVE
- NO NORMALLY OPEN
- NC NORMALLY CLOSED
- M MOTOR
- PUMP
- BLOWER

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	TG	SS	2020.07.07
Issued	By	Appd	YYYY.MM.DD

Permit/Seal

Consultant

Stantec
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 20015_P605 | AF Dwn. | NT Dsgn. | SS Chkd. | YYYY.MM.DD

Title
PROCESS FLOW DIAGRAM

Project No. 111720015
Scale
Revision
Sheet of
Drawing No. P-605

STANDING SEAM SHEET METAL ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 PRECOATED, GALVANIZED STEEL STANDING SEAM ROOFING, PANEL CLIP SYSTEM, ASSOCIATED INTEGRAL FLASHINGS, SUPPORT GIRTS AND PLYWOOD SUBSTRATE.

1.2 RELATED SECTIONS

.1 ROUGH CARPENTRY

.2 SHEET METAL FLASHING AND TRIM

1.3 REFERENCES

.1 ASTM A653/A653M-07 - STEEL SHEET, ZINC-COATED (GALVANIZED) OR ZINC-IRON ALLOY-COATED (GALVANNEALED) BY THE HOT-DIP PROCESS.

.2 ASTM B32-04 - SOLDER METAL.

.3 ROOFING PRACTICES MANUAL AS PUBLISHED BY THE ROOFING CONTRACTOR'S ASSOCIATION OF BRITISH COLUMBIA.

.4 SMACNA (SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION) - ARCHITECTURAL SHEET METAL MANUAL.

.5 THE VERSIONS OF THE STANDARDS REFERENCED IN THIS SECTION ARE THOSE LISTED IN THE BC BUILDING CODE, CURRENT EDITION AT THE TIME OF THE APPLICATION FOR BUILDING PERMIT; OR IF THEY ARE NOT REFERENCED IN THE SPECIFIED CODE, THEY ARE THE LATEST VERSION OF THE STANDARD IN EFFECT AT THE TIME OF THE APPLICATION FOR BUILDING PERMIT.

1.4 SUBMITTALS FOR REVIEW

.1 PRODUCT DATA: PROVIDE DATA ON METAL TYPES, FINISHES, CHARACTERISTICS, AND WARRANTY.

.2 SHOP DRAWINGS: INDICATE MATERIAL PROFILE, JOINTING PATTERN, JOINTING DETAILS, FASTENING METHODS, FLASHINGS, TERMINATIONS, AND INSTALLATION DETAILS.

1.5 QUALITY ASSURANCE

.1 PERFORM WORK IN ACCORDANCE WITH SMACNA STANDARD DETAILS AND REQUIREMENTS.

.2 FABRICATOR QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING THE PRODUCTS SPECIFIED IN THIS SECTION WITH MINIMUM FIVE (5) YEARS DOCUMENTED EXPERIENCE.

.3 INSTALLER QUALIFICATIONS: COMPANY SPECIALIZING IN PERFORMING THE WORK OF THIS SECTION WITH MINIMUM FIVE (5) YEARS DOCUMENTED EXPERIENCE AND APPROVED BY THE MANUFACTURER.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 DELIVER COMPONENTS TO JOBSITE PROPERLY PACKAGED TO PROVIDE PROTECTION DURING TRANSPORT, DELIVERY AND HANDLING.

.2 STACK PREFORMED AND PREFINISHED MATERIAL TO PREVENT TWISTING, BENDING, OR ABRASION, AND TO PROVIDE VENTILATION. SLOPE METAL SHEETS TO ENSURE DRAINAGE.

.3 PREVENT CONTACT WITH MATERIALS WHICH MAY CAUSE DISCOLORATION OR STAINING.

1.7 WARRANTY

.1 THE ROOFING CONTRACTOR WILL PROVIDE A CRCA TYPE WORKMANSHIP WARRANTY FOR THIS PROJECT, VALID FOR A PERIOD OF 2 YEARS FROM DATE OF SUBSTANTIAL PERFORMANCE.

.2 THE PRODUCT MANUFACTURER WARRANTY SHALL INCLUDE COVERAGE FOR DEGRADATION OF METAL FINISH, WATER TIGHTNESS, INTEGRITY OF SEALS AND THERMAL PERFORMANCE FOR A PERIOD OF 10 YEARS.

PART 2 PRODUCTS

2.1 FABRICATORS

.1 FLYNN CANADA LTD., ACCU-STEEL ROOFING PANELS OR APPROVED EQUAL.

2.2 SHEET MATERIALS

.1 PRE-COATED GALVANIZED STEEL: ASTM A653/A653M, GRADE A (Z275) GALVANIZED STEEL, 24-GAUGE CORE STEEL, SHOP PRE-COATED WITH PVDF SERIES PAINT FINISH.

.2 COLOUR OF STEEL ROOF PANELS TO BE SELECTED FROM STANDARD COLOURS. PRICE POINT TO BE IN THE RANGE OF THE CASCADIA METAL, CHAMPAGNE METALLIC.

2.3 ACCESSORIES

.1 FASTENERS: SAME MATERIAL AND FINISH AS FLASHING METAL, WITH SOFT NEOPRENE WASHERS.

.2 SHEET UNDERLAYMENT: CROSS-LAMINATED, HIGH DENSITY POLYETHYLENE FILM AND SELF-ADHESIVE RUBBERIZED ASPHALT, WITH EMBOSSED, SLIP-RESISTANT SURFACE, TO ASTM D412, 1.13 MM THICK. SHEET UNDERLAY SHALL BE CARLISLE CCW 300HT OR EQUAL.

.3 PLYWOOD SHEATHING: REFER TO– ROUGH CARPENTRY.

2.4 SHOP FABRICATION

.1 FORM SECTIONS TRUE TO SHAPE, ACCURATE IN SIZE, SQUARE, AND FREE FROM DISTORTION OR DEFECTS.

.2 FABRICATE CLEATS OF SHEET METAL, SAME MATERIAL AS SHEET, MINIMUM 100 MM WIDE, INTERLOCKABLE WITH SHEET. CLIPS TO BE DESIGNED TO ACCOMMODATE PANEL EXPANSION.

.3 FORM PIECES IN FULL LENGTH PANELS FOR EACH ROOF SECTION.

.4 FORM MATERIAL WITH STANDING SEAMS.

.5 FABRICATE CORNERS FROM ONE PIECE WITH MINIMUM 450 MM LONG LEGS; SEAL WITH SEALANT.

.6 FABRICATE VERTICAL FACES WITH BOTTOM EDGE FORMED OUTWARD 6 MM AND HEMMED TO FORM DRIP.

.7 FABRICATE FLASHINGS TO ALLOW TOE TO EXTEND 50 MM OVER ROOFING OR AS DETAILED. RETURN AND BRAKE EDGES.

PART 3 EXECUTION

3.1 EXAMINATION

.1 INSPECT ROOF DECK TO VERIFY DECK IS CLEAN AND SMOOTH, FREE OF NAIL PROTRUSIONS ETC.

.2 VERIFY DECK IS DRY AND FREE OF SNOW OR ICE.

.3 VERIFY ROOFING TERMINATION AND BASE FLASHINGS ARE IN PLACE, SEALED, AND SECURE.

3.2 PREPARATION

.1 INSTALL UNDERLAYMENT SHEET OVER PLYWOOD SHEATHING IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION. WEATHER LAP JOINTS 150 MM MINIMUM.

3.3 STANDING SEAM ROOFING

.1 CONFORM TO SMACNA DETAILS.

.2 SPACE STANDING SEAMS AT 450 MM ON CENTRE.

.3 LAY SHEETS WITH LONG DIMENSION PERPENDICULAR TO EAVES. APPLY PANS BEGINNING AT EAVES.

.4 LOCK CLEATS INTO SEAMS.

.5 AT EAVES AND GABLE ENDS, TERMINATE ROOFING BY HOOKING OVER EDGE STRIP.

.6 FINISH STANDING SEAMS 38MM HIGH ON FLAT SURFACES.

.7 TERMINATE STANDING SEAMS AT RIDGE AND HIPS BY TURNING DOWN WITH TAPERED FOLD.

3.4 FLASHINGS

.1 SECURE FLASHINGS IN PLACE USING CONCEALED FASTENERS. USE EXPOSED FASTENERS ONLY WHERE PERMITTED.

.2 CLEAT AND SEAM ALL JOINTS.

.3 APPLY PLASTIC CEMENT COMPOUND BETWEEN METAL FLASHINGS.

.4 FIT FLASHINGS TIGHT IN PLACE. MAKE CORNERS SQUARE, SURFACES TRUE AND STRAIGHT IN PLANES, AND LINES ACCURATE TO PROFILES.

.5 SEAL METAL JOINTS WATERTIGHT.

3.5 PROTECTION OF FINISHED WORK

.1 PROTECT BUILDING SURFACES AGAINST DAMAGE FROM ROOFING WORK.

.2 PROVIDE ADEQUATE HOARDING TO ALLOW ENTRANCE AND EXITING TO BUILDING

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED WORK

.1 STANDING SEAM SHEET METAL ROOFING

1.2 REFERENCES

.1 THE ALUMINUM ASSOCIATION INC. (AA)

.1 ALUMINUM SHEET METAL WORK IN BUILDING CONSTRUCTION-2000.
.2 AA DAF45-97, DESIGNATION SYSTEM FOR ALUMINUM FINISHES.

.2 THE VERSIONS OF THE STANDARDS REFERENCED IN THIS SECTION ARE THOSE LISTED IN THE BC BUILDING CODE, CURRENT EDITION AT THE TIME OF THE APPLICATION FOR BUILDING PERMIT; OR IF THEY ARE NOT REFERENCED IN THE SPECIFIED CODE, THEY ARE THE LATEST VERSION OF THE STANDARD IN EFFECT AT THE TIME OF THE APPLICATION FOR BUILDING PERMIT.

.3 ROOFING PRACTICES MANUAL AS PUBLISHED BY THE ROOFING CONTRACTOR'S ASSOCIATION OF BRITISH COLUMBIA.

PART 2 PRODUCTS

2.1 PREFINISHED STEEL SHEET

.1 PREFINISHED STEEL WITH FACTORY APPLIED POLYVINYLIDENE FLUORIDE, 24 GAUGE THICKNESS

.1 CLASS F1S F2S.

.2 COLOUR CHARTS: SUBMIT MANUFACTURER'S COLOUR CHARTS SHOWING FULL RANGE OF STANDARD COLORS AND FINISHES.

2.3 METAL FLASHINGS

.1 FORM FLASHINGS AND COPINGS TO PROFILES INDICATED.

2.4 ACCESSORIES

.1 PLASTIC CEMENT: TO CGSB 37-GP-5MA.

.2 SEALANTS: AS REQUIRED

.3 CLEATS: OF SAME MATERIAL, AND TEMPER AS SHEET METAL, MINIMUM 50 MM WIDE. THICKNESS SAME AS SHEET METAL BEING SECURED.

.4 FASTENERS: OF SAME MATERIAL AS SHEET METAL, TO CSA B111, CONCEALED APPLICATION.

.5 WASHERS: OF SAME MATERIAL AS SHEET METAL, 1 MM THICK WITH RUBBER PACKINGS.

.6 TOUCH-UP PAINT: AS RECOMMENDED BY PREFINISHED MATERIAL MANUFACTURER, TO BE PROVIDED TO OWNER.

.7 EAVES TROUGHS AND DOWNPIPES

.1 FORM 150MM EAVES TROUGHS USING PREFINISHED METAL CONTINUOUS TO CORNERS. DOWNPIPES SHALL BE FORMED FROM PREFINISHED ALUMINUM. ALL CORNERS SHALL BE PREFORMED AS WELL TO MATCH PROFILES.

.2 SIZES AND PROFILES AS NOTED OR AS INDICATED. DOWNSPOUTS MINIMUM SIZE 100MM X 100MM

.3 PROVIDE GOOSENECKS, OUTLETS, STRAINER BASKETS AND NECESSARY FASTENINGS.

2.4 FABRICATION

.1 FABRICATE METAL FLASHINGS AND OTHER SHEET METAL WORK IN ACCORDANCE WITH APPLICABLE CRCA 'FL' SERIES DETAILS AND AS INDICATED.

.2 FORM PIECES IN 2400 MM MAXIMUM LENGTHS. MAKE ALLOWANCE FOR EXPANSION AT JOINTS.

.3 HEM EXPOSED EDGES ON UNDERSIDE 12 MM. MITER AND SEAL CORNERS WITH SEALANT.

.4 FORM SECTIONS SQUARE, TRUE AND ACCURATE TO SIZE, FREE FROM DISTORTION AND OTHER DEFECTS DETRIMENTAL TO APPEARANCE OR PERFORMANCE.

PART 3 EXECUTION

3.1 INSTALLATION

.1 INSTALLATION

.1 INSTALL SHEET METAL WORK IN ACCORDANCE WITH CRCA FL SERIES DETAILS, AND AS DETAILED.

.2 USE CONCEALED FASTENINGS EXCEPT WHERE APPROVED BEFORE INSTALLATION.

.3 PROVIDE UNDERLAY UNDER SHEET METAL. SECURE IN PLACE AND LAP JOINTS 150 MM.

.4 FLASH JOINTS USING S-LOCK STANDING SEAMS FORMING TIGHT FIT OVER HOOK STRIPS, AS DETAILED.

.5 LOCK END JOINTS AND CAULK WITH SEALANT.

.6 ALL VERTICAL FLASHINGS TO BE SECURED TO FACE OF BUILDING WITH CONCEALED WIND CLIPS TO PREVENT UPLIFT.

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	AK	SMS	2020.07.07
Issued	By	Appd	YYYY.MM.DD

Permit/Seal

Consultant

Stantec
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 20015_A100_A102	AK	SMS	SS	
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

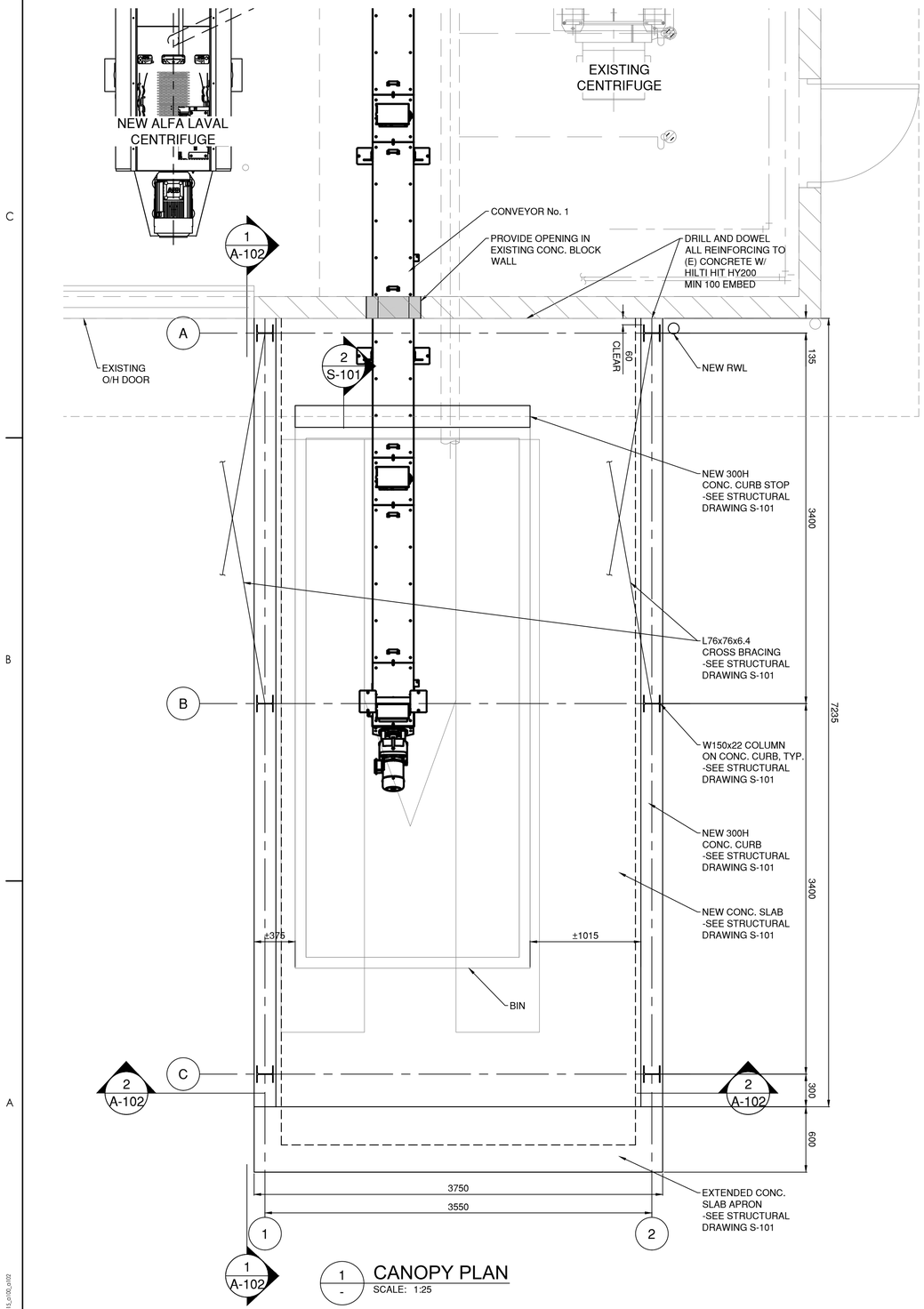
Title
ARCHITECTURAL SPECIFICATIONS

Project No.	Scale
111720015	N/A

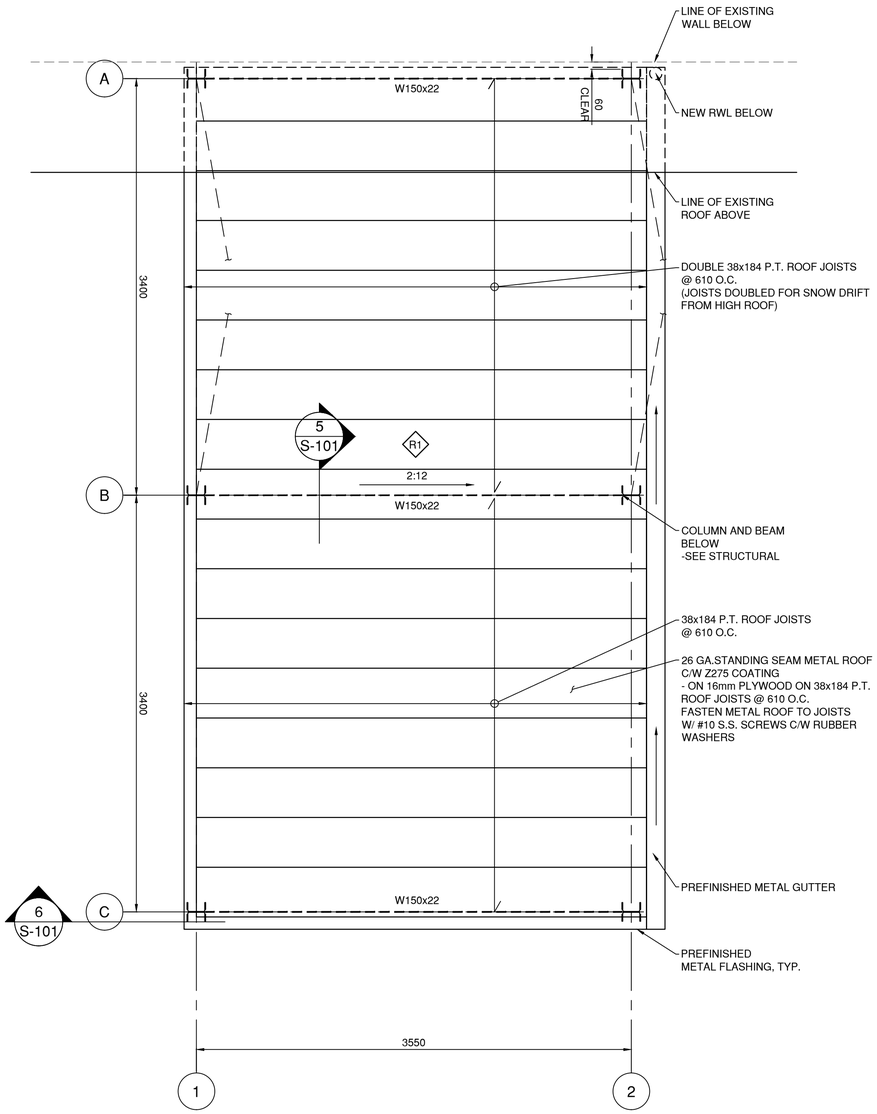
Revision | Sheet of | Drawing No. A-100

ROOF ASSEMBLY	
ROOF TAG	**DESCRIPTION**
R1	• STANDING SEAM METAL ROOF • SLIP SHEET • ROOF UNDERLAYMENT • 16mm PLYWOOD SHEATHING • STRUCTURE

ALL STRUCTURAL STEEL
(INCLUDING BOLTS AND HARDWARE)
TO BE HOT-DIP GALVANIZED



1 / - CANOPY PLAN
SCALE: 1:25



2 / - CANOPY ROOF PLAN
SCALE: 1:25

1:25 0 0.25 0.75 1.25m

Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
1 FOR TENDER	AK	SMS	2020.07.07

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 20015_A100_A102

AK	SMS	SS	
Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

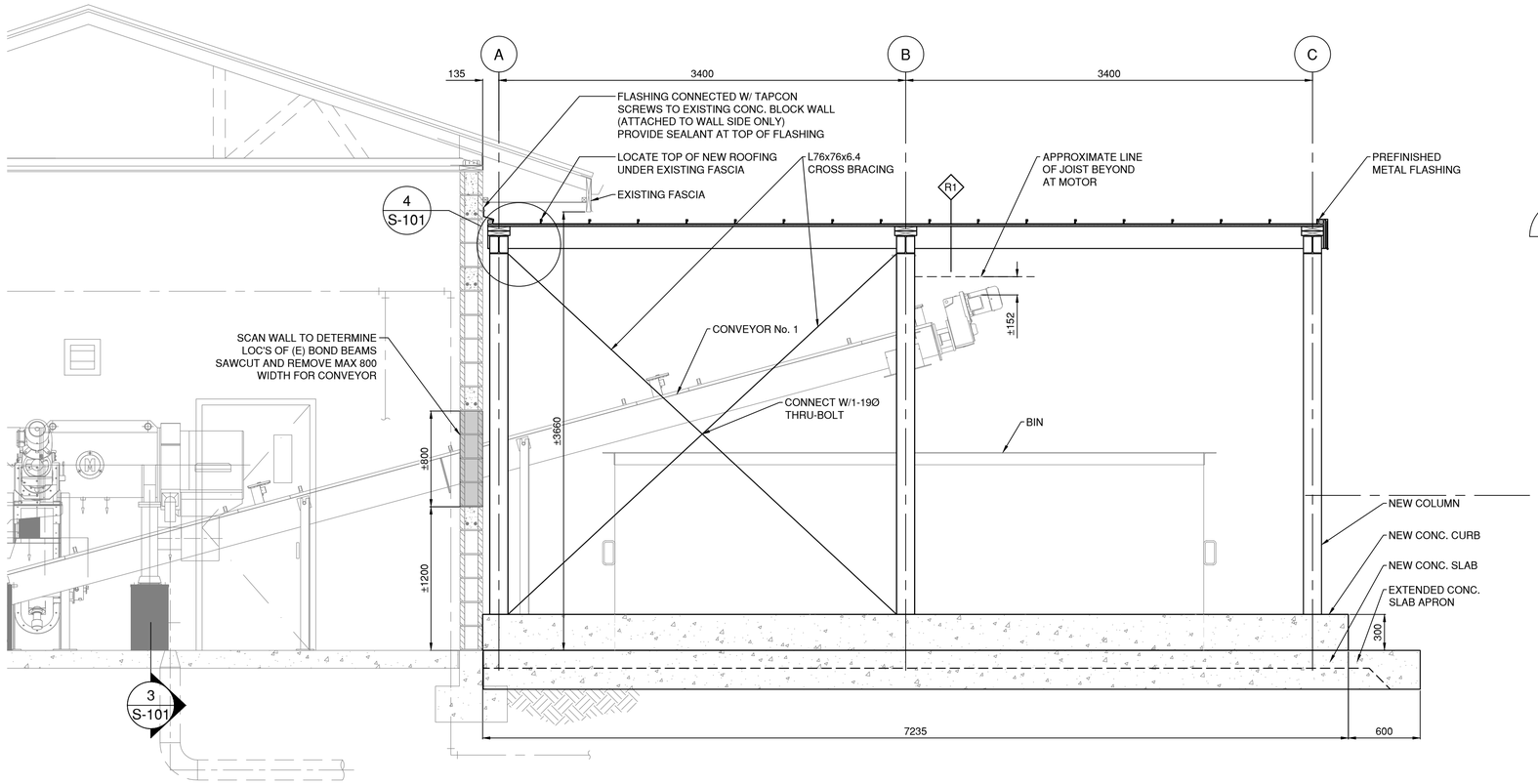
Title
CANOPY PLAN AND ROOF PLAN

Project No.
111720015

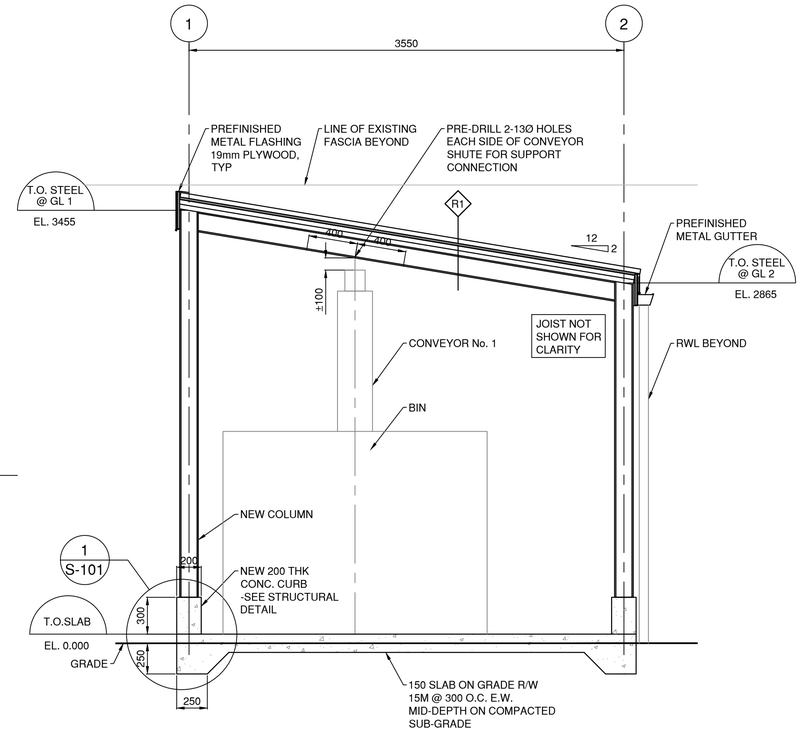
Scale
1:25

Revision | Sheet of

Drawing No.
A-101



1 / A-101 SECTION
SCALE: 1:25



2 / A-101 SECTION
SCALE: 1:25

0 0.25 0.75 1.25m
1:25

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	AK	SMS	2020.07.07
Issued	By	Appd	YYYY.MM.DD

Permit/Seal

Consultant

Stantec
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo
District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 20015_A100_A102 | AK Dwn. | SMS Dsgn. | SS Chkd. | YYYY.MM.DD

Title
CANOPY SECTIONS

Project No. 111720015
Scale 1:25
Revision
Sheet of
Drawing No. A-102

ORIGINAL SHEET - ISO A1

STRUCTURAL DESIGN NOTES

GENERAL

1 ALL CODES REFERENCED ARE TO BE THE LATEST VERSION AT THE DATE OF ISSUE.
2 DESIGN IS BASED ON THE BRITISH COLUMBIA BUILDING CODE 2018.
3 READ THESE DESIGN NOTES IN CONJUNCTION WITH THE CONTRACT SPECIFICATIONS AND ALL OTHER CONTRACT DOCUMENTS.
4 OBTAIN ENGINEER'S APPROVAL BEFORE CUTTING, BORING, OR SLEEVING LOAD-BEARING MEMBERS UNLESS NOTED OTHERWISE.
5 THE STRUCTURAL DRAWINGS ARE FOR THE COMPLETED PROJECT. STABILITY OF THE NEW STRUCTURE DURING CONSTRUCTION REMAINS THE RESPONSIBILITY OF THE CONTRACTOR.
6 REFER TO CIVIL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR SMALL OPENINGS, SLEEVES, RECESSES, DEPRESSIONS, SUMPS, TRENCHES, CURBS, HOUSEKEEPING PADS, EQUIPMENT BASES, AND SLOPES NOT INDICATED ON THE STRUCTURAL DRAWINGS.
7 OPENINGS AND SLEEVES INDICATED ON THE STRUCTURAL DRAWINGS ARE FOR REFERENCE ONLY. COORDINATE ALL OPENING LOCATIONS AND DIMENSIONS WITH THE APPROPRIATE CONSULTANT AND THE SUB-CONTRACTOR PRIOR TO CONSTRUCTION.
8 REVIEW ALL DRAWINGS AND CHECK DIMENSIONS PRIOR TO IMPLEMENTING THE WORK. REPORT ANY DISCREPANCIES TO THE CONSULTANT FOR CLARIFICATION BEFORE PROCEEDING.
9 COORDINATE PLACEMENT AND LOCATION OF ITEMS BY SUBSEQUENT TRADES. RELEVANT TRADES SHALL REVIEW PRIOR TO ERECTION AND/OR INSTALLATION.
10 NOTIFY THE ENGINEER A MINIMUM OF 48 HOURS PRIOR TO ANY REQUIRED SITE REVIEWS.

EXISTING STRUCTURES

1 NOTIFY ENGINEER OF ANY STRUCTURES OR SERVICES NOT SHOWN ON THE STRUCTURAL DRAWINGS.

DESIGN LOADS

1 UNLESS NOTED OTHERWISE, THE LOADS NOTED IN TABLES AND ON DRAWINGS ARE UNFACTORED.
2 CLIMATIC INFORMATION — REFER TO CLIMATIC INFORMATION TABLE
3 SITE INFORMATION — REFER TO SITE INFORMATION TABLE
4 DESIGN LOADS — REFER TO DESIGN LOADS TABLE
5 LATERAL LOADS
5.1 CLIMATIC INFORMATION REFER TO CLIMATIC INFORMATION TABLE SHEAR WALLS.
5.2 SEE FORCE MODIFICATION FACTORS TABLE
6 CONSTRUCTION LOADS SHALL NOT EXCEED THE LOADS NOTED ON THE DRAWINGS.

DELEGATED DESIGN

1 PORTIONS OF THE DETAILED DESIGN ARE DELEGATED TO THE CONTRACTOR. RETAIN A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA TO COMPLETE THE DESIGN.
2 SUBMIT SHOP DRAWINGS FOR COMPONENTS REQUIRING DELEGATED DESIGN UNDER THE SEAL AND SIGNATURE OF THE ENGINEER RESPONSIBLE FOR THE DESIGN.
3 THE FOLLOWING COMPONENTS REQUIRE DELEGATED DESIGN:
3.1 MORTAR, GROUT, AND CONCRETE MIX DESIGNS
3.2 SUPPORT AND SEISMIC RESTRAINT OF EQUIPMENT.
4 THE ENGINEER RESPONSIBLE FOR THE DESIGN IS ALSO RESPONSIBLE FOR REVIEW OF FABRICATION AND INSTALLATION OF THE COMPONENTS. UPON COMPLETION OF THE WORK, PROVIDE SCHEDULE S-B's AND S-C's TO THE ENGINEER OF RECORD.
5 REFER TO SPECIFICATIONS FOR FURTHER REQUIREMENTS.

FOUNDATION AND GEOTECHNICAL NOTES

1 BEAR ALL CONCRETE ON UNDISTURBED SOIL OR COMPACTED ENGINEERED FILL.
2 REMOVE ALL ORGANIC MATERIAL FROM THE EXTERIOR SLAB AREA.
3 REMOVE ALL LOOSE OR SATURATED MATERIAL AND GROUNDWATER FROM THE BASE OF FOOTING EXCAVATIONS BY APPROVED METHODS PRIOR TO PLACING FOUNDATIONS.
4 PROTECT EXCAVATIONS FOR FOOTINGS FROM RAIN, SNOW, FREEZING TEMPERATURES, STANDING WATER, LOSS OF MOISTURE AND DEGRADATION BY APPROVED METHODS.
5 BEARING SURFACES TO BE REVIEWED IN THE FIELD BY A PROFESSIONAL GEOTECHNICAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA PRIOR TO PLACING CONCRETE. IMPROVE SUBGRADE AS DIRECTED IN WRITING BY A PROFESSIONAL GEOTECHNICAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.
6 GEOTECHNICAL TESTING AGENCY TO BE APPROVED BY AND RESPONSIBLE TO THE ENGINEER AND PAID FOR BY THE OWNER.
7 UNLESS OTHERWISE SHOWN ON PLAN, FOUNDATION ELEMENTS ARE TO BE CENTERED UNDER WALLS, GRADE BEAMS, AND COLUMNS.
8 PROVIDE DOWELS FROM FOOTINGS TO MATCH ALL VERTICAL COLUMN AND WALL REINFORCEMENT OR AS NOTED ON THE DRAWINGS.
9 ENGINEERED FILL MATERIAL TO BE APPROVED BY GEOTECHNICAL ENGINEER. COMPACTION AND MAXIMUM THICKNESS OF ENGINEERED FILL AS PER GEOTECHNICAL REPORT.
10 A MINIMUM 150 mm BLANKET OF FREE DRAINING, WELL GRADED, 25 mm MINUS GRANULAR MATERIAL SHALL BE PLACED IMMEDIATELY BELOW THE SLAB AND COMPACTED TO 95% OF STANDARD PROCTOR DRY DENSITY. MATERIAL TO BE APPROVED BY GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT.

CAST-IN-PLACE REINFORCED CONCRETE

1 CONCRETE MATERIALS, QUALITY, MIXING, PLACING, FORMWORK AND OTHER CONSTRUCTION PRACTICES TO CONFORM TO CSA-A23.1.
2 SUPPLY CONTROLLED CONCRETE IN ACCORDANCE WITH CSA-A23.1 WITH PROPERTIES NOTED IN CONTROLLED CONCRETE TABLE.
3 MAXIMUM FLY ASH CONTENT NOT TO EXCEED 25% OF THE TOTAL CEMENTITIOUS MATERIAL.
4 NOTIFY CONSULTANT 48 HOURS PRIOR TO CONCRETE POURS TO ALLOW FOR REVIEW OF REINFORCEMENT.
5 DO NOT USE ADMIXTURES CONTAINING CALCIUM CHLORIDE.
6 FOR FLOOR SLABS, DESIGN THE CONCRETE MIX WITH AGGREGATE GRADING AND WATER TO CEMENTING MATERIALS RATIO TO MINIMIZE SHRINKAGE.
7 FIELD AND LABORATORY TESTING OF CONCRETE TO BE COMPLETED BY A THIRD PARTY TESTING AND INSPECTION AGENCY APPROVED BY AND RESPONSIBLE TO THE ENGINEER. TESTING AGENCY SHALL BE CERTIFIED TO CSA-A283. ONE SET OF 3 CYLINDERS SHALL BE MADE FOR EACH DAY'S POUR. COPIES OF TEST RESULTS SHALL BE SENT TO THE ENGINEER AND CONTRACTOR. CONTRACTOR SHALL PAY FOR TESTS.
8 COLD WEATHER REQUIREMENTS FOR POURING CONCRETE AS DEFINED BY CAN/CSA-A23.1, CLAUSE 7.4.2.5 MUST BE MET. CONTRACTOR SHALL ENSURE THAT ALL PRECAUTIONS ARE TAKEN TO ADEQUATELY CURE CONCRETE IN COLD WEATHER INCLUDING BUT NOT LIMITED TO: HEATING THE MIXING WATER, ADDING ACCELERATOR TO THE CONCRETE MIX, COVERING THE CONCRETE AND HEATING THE CONCRETE. WHEN THERE IS A PROBABILITY OF THE TEMPERATURE FALLING BELOW 5°C , AN ADDITIONAL CONCRETE CYLINDER (4 TOTAL) SHALL BE MADE. A MINIMUM OF 2 - 28 DAY SAMPLES SHALL BE LEFT ON SITE FOR 28 DAYS MINIMUM AND STORED UNDER SIMILAR TEMPERATURE AND HUMIDITY CONDITIONS AS THE IN-PLACE CONCRETE.
9 HOT WEATHER REQUIREMENTS FOR POURING CONCRETE AS DEFINED BY CAN/CSA-A23.1, CLAUSE 7.4.1.8.1 MUST BE MET. WHEN THERE IS A PROBABILITY OF THE TEMPERATURE RISING ABOVE 27°C , AN ADDITIONAL CONCRETE CYLINDER (4 TOTAL) SHALL BE MADE. A MINIMUM OF 2 - 28 DAY SAMPLES SHALL BE LEFT ON SITE FOR 28 DAYS MINIMUM AND STORED UNDER SIMILAR TEMPERATURE AND HUMIDITY CONDITIONS AS THE IN-PLACE CONCRETE.

CONCRETE REINFORCEMENT

1 REINFORCEMENT STEEL TO CONFORM TO CSA-G30.18 GRADE 400.
2 DO NOT WELD REINFORCEMENT UNLESS APPROVED IN WRITING BY THE ENGINEER. REINFORCEMENT TO BE WELDED TO CONFORM TO CSA-G30.18, GRADE 400W. WELDING ONLY PERMITTED BY AN ORGANIZATION CERTIFIED TO CSA-W186.
3 NOTIFY THE ENGINEER PRIOR TO CONCRETE PLACEMENT TO ALLOW FOR REVIEW OF REINFORCING.
4 REINFORCEMENT NOTED WITH "H1E" TO HAVE A STANDARD HOOK AT ONE END. LENGTH OF BAR INDICATED IS EXCLUSIVE OF HOOK LENGTH.
5 CLEAR CONCRETE COVER TO REINFORCEMENT - REFER TO CLEAR CONCRETE COVER TO REINFORCEMENT TABLE.
6 STANDARD END HOOK LENGTHS FOR REINFORCING - REFER TO STANDARD END HOOKS TABLE.
7 REINFORCEMENT SPLICES - REFER TO REINFORCEMENT SPLICES TABLE.
9.1 WHERE SPLICES ARE INDICATED ON THE DRAWINGS, SUCH DIMENSIONS SHALL APPLY.
9.2 WHERE THE DRAWINGS INDICATE TENSION OR COMPRESSION SPLICES, IT SHALL BE AS INDICATED IN REINFORCEMENT SPLICES TABLE.
9.3 WHERE NO SPLICE OR SPLICE TYPE IS INDICATED ON THESE DRAWINGS, IT SHALL BE A TENSION SPLICE EXCEPT FOR COLUMNS WHICH SHALL BE A COMPRESSION SPLICE.
8 EMBEDMENT OF DOWELS - REFER TO REINFORCEMENT SPLICES TABLE.
10.1 WHERE EMBEDMENT IS DIMENSIONED ON THE DRAWINGS, SUCH DIMENSIONS SHALL APPLY.
10.2 WHERE THE DRAWINGS INDICATE TENSION OR COMPRESSION EMBEDMENT, IT SHALL BE AS NOTED IN THE REINFORCEMENT SPLICES TABLE.
10.3 WHERE NO EMBEDMENT OR EMBEDMENT TYPE IS INDICATED ON THESE DRAWINGS, IT SHALL BE A TENSION EMBEDMENT EXCEPT FOR COLUMNS WHICH SHALL BE A COMPRESSION EMBEDMENT.
9 OPENINGS IN WALLS AND SLABS - PROVIDE TWO 15M BARS EACH SIDE, ONE EACH FACE, EXTENDING 600mm PAST THE OPENINGS, PLUS TWO 15M DIAGONAL BARS AT EACH CORNER, EACH FACE 1200mm LONG UNLESS NOTED OTHERWISE.
10 DO NOT CUT REINFORCEMENT AT OPENINGS WHERE IT CAN BE SPREAD CONTINUOUS AROUND OPENING.
11 ALL REINFORCEMENT TO BE SUPPORTED AT 900mm MAXIMUM SPACING.

CONCRETE FORMWORK

1 DESIGN, FABRICATION, ERECTION, AND OTHER CONSTRUCTION PRACTICES TO CONFORM TO CAN/CSA-S269.3.

MASONRY

1 DESIGN, FABRICATION, ERECTION, AND OTHER CONSTRUCTION PRACTICES TO CONFORM TO CSA S304.1 AND CAN/CSA-A371.
2 CONCRETE BLOCK TO CONFORM TO CAN/CSA-A165 WITH A MINIMUM COMPRESSIVE STRENGTH OF 15MPa BASED ON THE NET CROSS-SECTIONAL AREA OF THE UNITS WITH VOIDS.

STRUCTURAL STEEL

1 DESIGN, FABRICATION, ERECTION, AND OTHER CONSTRUCTION PRACTICES TO CONFORM TO CSA-S16 AND THE CISC CODE OF STANDARD PRACTICE FOR STRUCTURAL STEEL.
2 STEEL TO BE FABRICATED AND ERECTED BY A SHOP CERTIFIED BY THE CANADIAN WELDING BUREAU TO THE REQUIREMENTS OF CSA-W47.1, DIVISION 1 OR 2.1 ONLY.
3 SUBMIT SHOP DRAWINGS SHOWING ALL STRUCTURAL STEEL MEMBERS FOR REVIEW PRIOR TO FABRICATION. WELDING TO CONFORM TO CSA-W59.
4 WELDING TO REINFORCEMENT STEEL ONLY BY A SHOP CERTIFIED TO CSA-W186 WITH REINFORCEMENT CONFORMING TO CSA-G30.18, GRADE 400W.
5 SHOP GALVANIZING TO CONFORM TO CAN/CSA-G164. ALL STRUCTURAL STEEL (INCLUDING BOLTS AND HARDWARE) TO BE HOT DIPPED GALVAINIZED.
6 ALL EXPOSED WELDS TO BE CONTINUOUS. GRIND ALL EXPOSED WELDS SMOOTH, INCLUDING PAINTED STEEL.
7 SUPPLY STEEL WITH PROPERTIES NOTED IN STEEL GRADES TABLE.
8 PROVIDED A MINIMUM OF 2 BOLTS IN BOLTED CONNECTIONS.
9 ALL BOLTED CONNECTIONS TO USE SNUG-TIGHTENED HIGH-STRENGTH BOLTS UNLESS OTHERWISE NOTED ON THE DRAWINGS.
10 DO NOT SPLICE MATERIAL WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER. WHERE GRANTED, A COMPLETE NON-DESTRUCTIVE EXAMINATION WILL BE MANDATORY AND PAID FOR BY THE SUB-CONTRACTOR.
11 ALL GROUT UNDER BEARING PLATES AND BASE PLATES SHALL BE NON-METALLIC, NON-SHRINK TYPE WITH MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 50 MPa, INSTALLED IN ACCORDANCE WITH THE SPECIFICATION AND MANUFACTURER'S RECOMMENDATIONS. PROVIDE GROUT WEEP HOLES IN COLUMN BASE PLATES WHERE SHOWN.

TIMBER

1 DESIGN, FABRICATION, ERECTION, AND OTHER CONSTRUCTION PRACTICES TO CONFORM TO CSA-086AND CAN/CSA-O122 AS WELL AS ALL OF THE REQUIREMENTS OF PART 9 OF THE BRITISH COLUMBIA BUILDING CODE, LATEST EDITION. ALL LUMBER SHALL HAVE A MOISTURE CONTENT NOT EXCEEDING 19% AT TIME OF INSTALLATION.
2 SUPPLY TIMBER WITH PROPERTIES NOTED IN TIMBER GRADES TABLE.
3 BOLTS TO CONFORM TO ASTM A307.
4 JOIST HANGERS TO BE GALVANIZED SADDLE TYPE ONLY, NAILED PER THE MANUFACTURER'S RECOMMENDATIONS TO DEVELOP FULL CAPACITY OF HANGER.
5 PROVIDE A 25 mm GAP BETWEEN NON-LOAD-BEARING PARTITION WALLS AND STRUCTURE ABOVE TO ALLOW FOR DEFLECTION.
6 WOOD FRAMING GRADE NO. 2 OR BETTER PRESSURE TREATED
7 NAILS SPIKES AND STAPLES: TO CSA-B111.
8 BOLTS: TO ASTM A307, COMPLETE WITH NUTS AND WASHERS.

PLYWOOD AND STRANDBOARD SHEATHING

1 ALL PLYWOOD SHALL CONFORM TO CAN/CSA-0121 DOUGLAS FIR PLYWOOD. ORIENTED STRANDBOARD (OSB) SHEATHING SHALL CONFORM TO CAN/ CSA-0437.0/0437.1 AND CAN/CSA-0437.2.
2 ROOF SHEATHING: D-FIR SHEATHING GRADE AND MARKED PMBC EXTERIOR 16 mm, SHEET SIZE 1200 mm x 2400 mm.
3 FACE GRAIN OF PLYWOOD SHEETS ARE TO BE PERPENDICULAR TO SUPPORTING JOISTS OR WALLS STUDS.
4 END JOINTS IN ADJACENT PLYWOOD SHEETS ARE TO BE STAGGERED 1200 mm.
5 END JOINTS OF PLYWOOD ARE TO BEAR ON SUPPORTING JOISTS OR STUDS AND BUTT ALONG THEIR CENTRE LINES SUCH THAT NAIL EDGE DISTANCE IS NOT LESS THAN 10 mm.
6 FASTEN PLYWOOD WITH 3.3 mm MINIMUM DIAMETER PNEUMATIC NAILS. NAILING PATTERN AS NOTED ON DRAWING.
7 ROOF DIAPHRAGM: BLOCK ALL UNSUPPORTED PLYWOOD EDGES WITH 38 x 89 ON FLAT UNLESS NOTED OTHERWISE.

CLIMATIC INFORMATION	
TO BE READ IN CONJUNCTION WITH DESIGN LOADS DESIGN NOTES	
SNOW LOAD (1/50), Ss	1.3 kPa
SNOW LOAD (1/50), Sr	0.3 kPa
ONE DAY RAIN (1/50)	130 mm
HOURLY WIND PRESSURE (1/10)	0.37 kPa
HOURLY WIND PRESSURE (1/50)	0.48 kPa
SEISMIC RESPONSE, Sa(0.2)	1.34
SEISMIC RESPONSE, Sa(0.5)	1.24
SEISMIC RESPONSE, Sa(1.0)	0.752
SEISMIC RESPONSE, Sa(2.0)	0.456
SEISMIC RESPONSE, PGA	0.605

FORCE MODIFICATION TABLE		
CANOPY	Rd	Ro
CONVENTIONAL BRACE FRAME	1.5	1.3

STEEL GRADES	
TO BE READ IN CONJUNCTION WITH STRUCTURAL STEEL DESIGN NOTES	
MEMBER TYPE	GRADE
ROLLED W-SHAPES, TEES	CSA G40.21 350W OR ASTM A992 GRADE 50
OTHER STRUCTURAL SHAPES & PLATES	CSA G40.21 300W
STEEL TO STEEL BOLTS	ASTM A325
THREADED ROD	ASTM A36

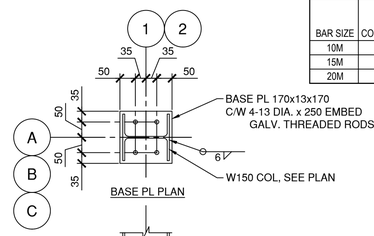
CLEAR CONCRETE COVER TO REINFORCEMENT			
TO BE READ IN CONJUNCTION WITH CONCRETE REINFORCEMENT DESIGN NOTES			
	EXPOSURE CLASS		
EXPOSURE CONDITION	N	F-1, F-2, S-1, S-2, S-3	C-XL, C-1, C-2, C-3, A-1, A-2, A-3
CAST AGAINST FORMWORK OR EXPOSED SURFACE OF SLABS	-	40 mm	60 mm
CAST AGAINST SOIL	-	75 mm	75 mm

CONTROLLED CONCRETE						
TO BE READ IN CONJUNCTION WITH CAST-IN-PLACE REINFORCED CONCRETE DESIGN NOTES						
CONCRETE ELEMENT	CLASS OF EXPOSURE	MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS (MPa)	MAXIMUM AGGREGATE SIZE (mm)	AIR CONTENT CATEGORY	MAX W/C RATIO	CEMENT TYPE
EXT SLAB-ON-GRADE AND CENTRIFUGE PEDESTAL	C-1	35	20	1	0.45	GU
MASONRY COREFILL	N	15	12	-	0.55	GU

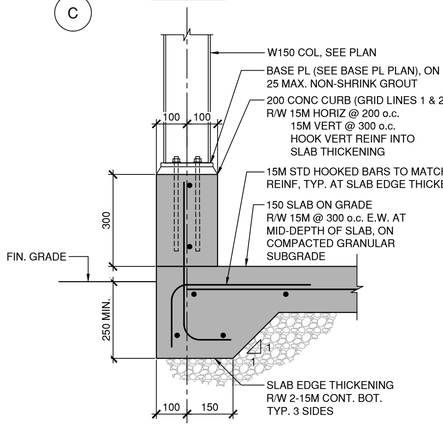
REINFORCEMENT SPLICES			
TO BE READ IN CONJUNCTION WITH CONCRETE REINFORCEMENT DESIGN NOTES.			
NOTES:			
1. THIS TABLE IS BASED ON NORMAL WEIGHT CONCRETE f'c = 35 MPa AND ON REINFORCING STEEL fy = 400 MPa.			
2. TOP HORIZONTAL BARS ARE DEFINED AS HORIZONTAL REINFORCEMENT PLACED SUCH THAT MORE THAN 300mm OF CONCRETE IS CAST IN THE MEMBER BELOW THE REINFORCEMENT.			
3. FOR STANDARD EMBEDMENT DEPTH INTO CONCRETE, DIVIDE BASIC TENSION LAP SPLICE NUMBERS BY 1.3.			
		TENSION SPLICE (mm)	
		VERTICAL OR BOTTOM HORIZONTAL BARS	TOP HORIZONTAL BARS
BAR SIZE	COMPRESSION SPLICE (mm)	UNCOATED BARS	UNCOATED BARS
10M	300	400	500
15M	450	600	750
20M	600	800	1000

TYPICAL ABBREVIATIONS

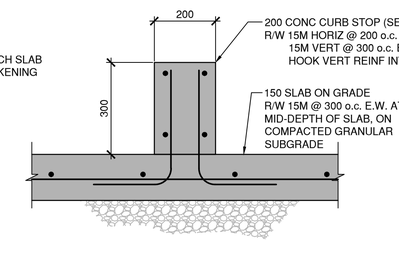
ADDL	"ADDITIONAL"	LG.	"LONG"
ALT	"ALTERNATE"	MAX	"MAXIMUM"
ALUM	"ALUMINUM"	MECH	"MECHANICAL"
APPD	"APPROVED"	MIN	"MINIMUM"
APPROX or ±	"APPROXIMATELY"	NTS	"NOT TO SCALE"
ARCH	"ARCHITECT"	O.C.	"ON CENTER"
AR or A.ROD	"ANCHOR ROD"	O.F.	"OUTSIDE FACE"
B.L.L.	"BOTTOM LOWER LAYER"	OPNG	"OPENING"
B.U.L.	"BOTTOM UPPER LAYER"	OPP	"OPPOSITE"
BM	"BEAM"	PL	"PLATE"
BOT	"BOTTOM"	R/W	"REINFORCE WITH"
BS	"BOTH SIDES"	REINF	"REINFORCING"
C/W	"COMPLETE WITH"	S.F.	"STEP FOOTING"
CANT	"CANTILEVER"	S.W.	"SHORT WAY"
CLR	"CLEAR"	SIM	"SIMILAR"
CMU	"CONCRETE MASONRY UNIT"	STAGG	"STAGGERED"
COL	"COLUMN"	STIFF	"STIFFENER"
CONC	"CONCRETE"	STIRR	"STIRRUPS"
CONN	"CONNECTION"	SYMM	"SYMMETRICAL"
CONT	"CONTINUOUS"	T&B	"TOP & BOTTOM"
CP	"COMPLETE PENETRATION" (WELD)	T.L.L.	"TOP LOWER LAYER"
DIA	"DIAMETER"	T.O.	"TOP OF"
DWG	"DRAWING"	T.O.F.	"TOP OF FOOTING"
DWL	"DOWEL"	T.O.S.	"TOP OF STEEL"
(E)	"EXISTING"	T.O.W.	"TOP OF WALL"
E.F.	"EACH FACE"	T.U.L.	"TOP UPPER LAYER"
E.S.	"EACH SIDE"	THK	"THICK"
E.W.	"EACH WAY"	TYP	"TYPICAL"
EL	"ELEVATION"	U.N.O.	"UNLESS NOTED OTHERWISE"
ELEV	"ELEVATION"	U/S	"UNDERSIDE"
FTG	"FOOTING"	VERT	"VERTICAL"
H1E	"HOOK ONE END"	VIF	"VERIFY IN FIELD"
H2E	"HOOK TWO ENDS"	W/	"WITH"
HORIZ	"HORIZONTAL"	WP	"WORK POINT"
I.F.	"INSIDE FACE"	WWW	"WELDED WIRE MESH"
L.W.	"LONG WAY"		



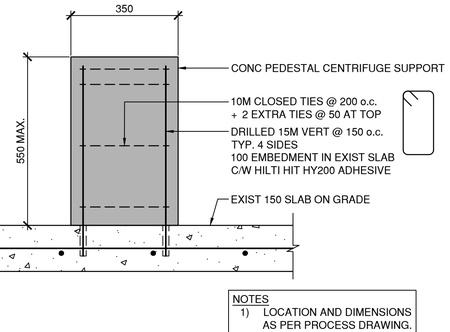
BASE PL PLAN



1 S-101 SECTION
SCALE: 1:10

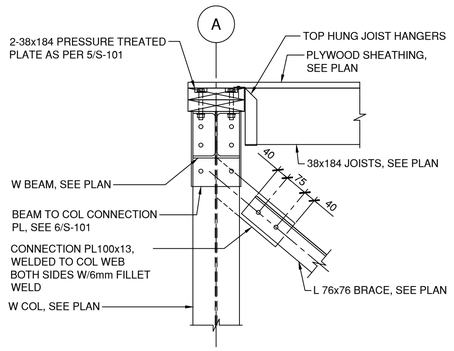


2 S-101 CURB STOP DETAIL
SCALE: 1:10

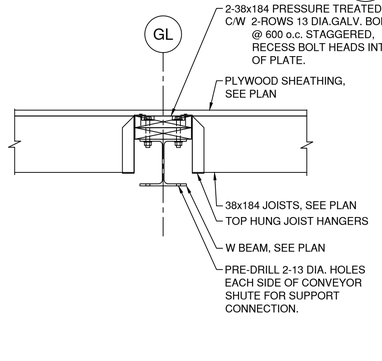


3 S-101 CENTRIFUGE SUPPORT DETAIL
SCALE: 1:10

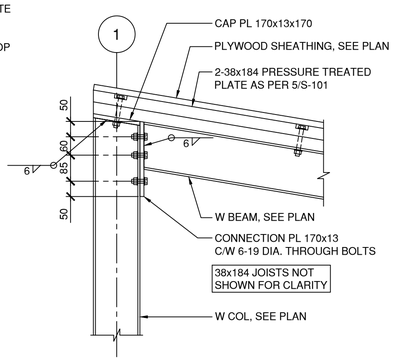
NOTES
1) LOCATION AND DIMENSIONS AS PER PROCESS DRAWING.
2) ANCHORAGE OF UNIT BY SUPPLIER.



4 S-101 SECTION
SCALE: 1:10



5 S-101 SECTION
SCALE: 1:10



6 S-101 SECTION
SCALE: 1:10

1:10 0 0.1 0.3 0.5m

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	AD	BJG	2020.07.07
Issued	By	Appd	YYYY.MM.DD

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

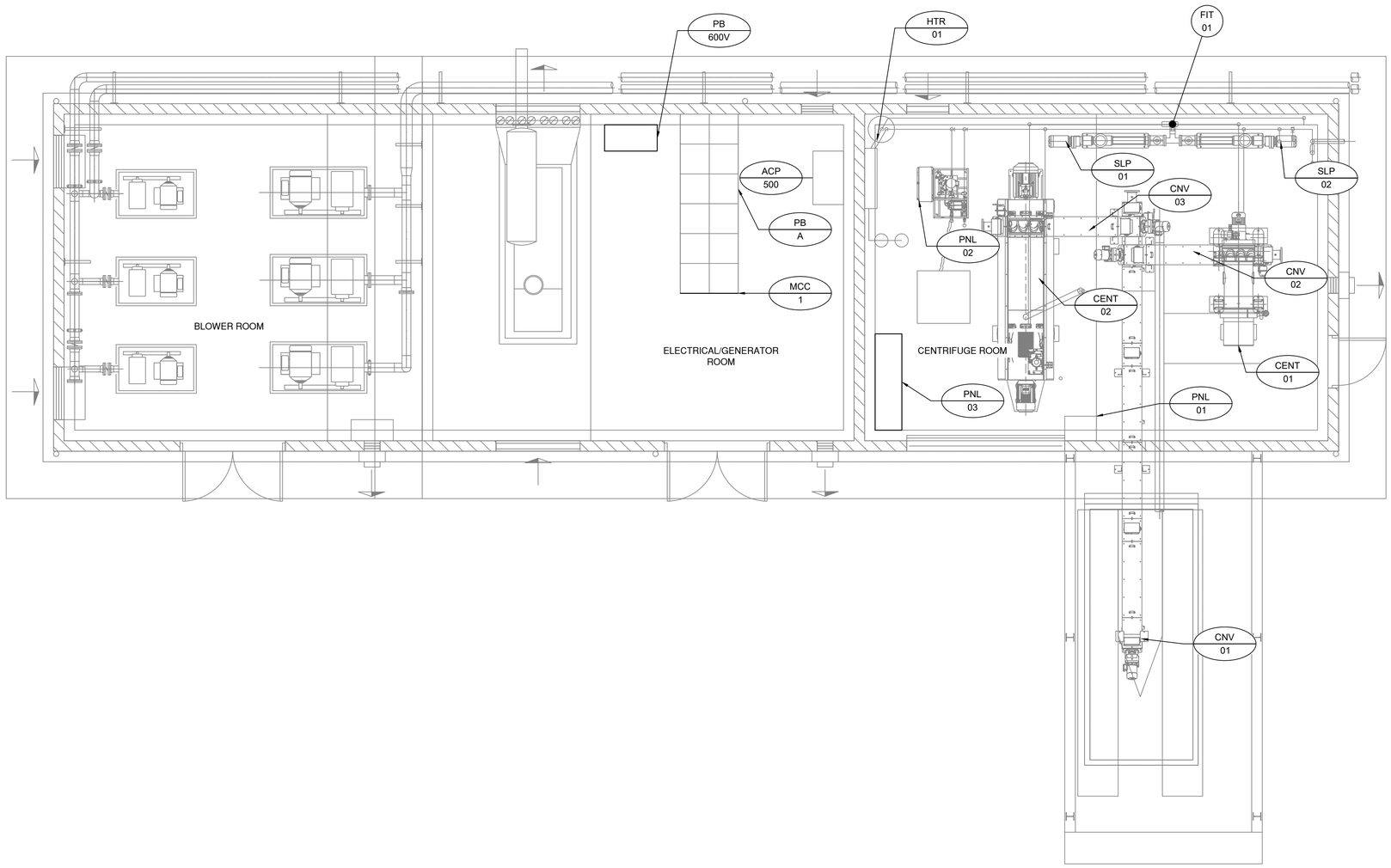
WWTP UPGRADES 2020

Sooke BC

File Name: S101	AD	BJG	BJG	2020.02.12
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Title
GENERAL STRUCTURAL NOTES AND DETAILS

Project No. 111720015
Scale AS INDICATED
Revision
Sheet 1 of 1
Drawing No. S-101



Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
1 FOR TENDER	RPH	SAL	2020.07.07

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 111720015_E101

Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
RPH	RPH	SAL	

Title

CENTRIFUGE & ELECTRICAL ROOM LAYOUT

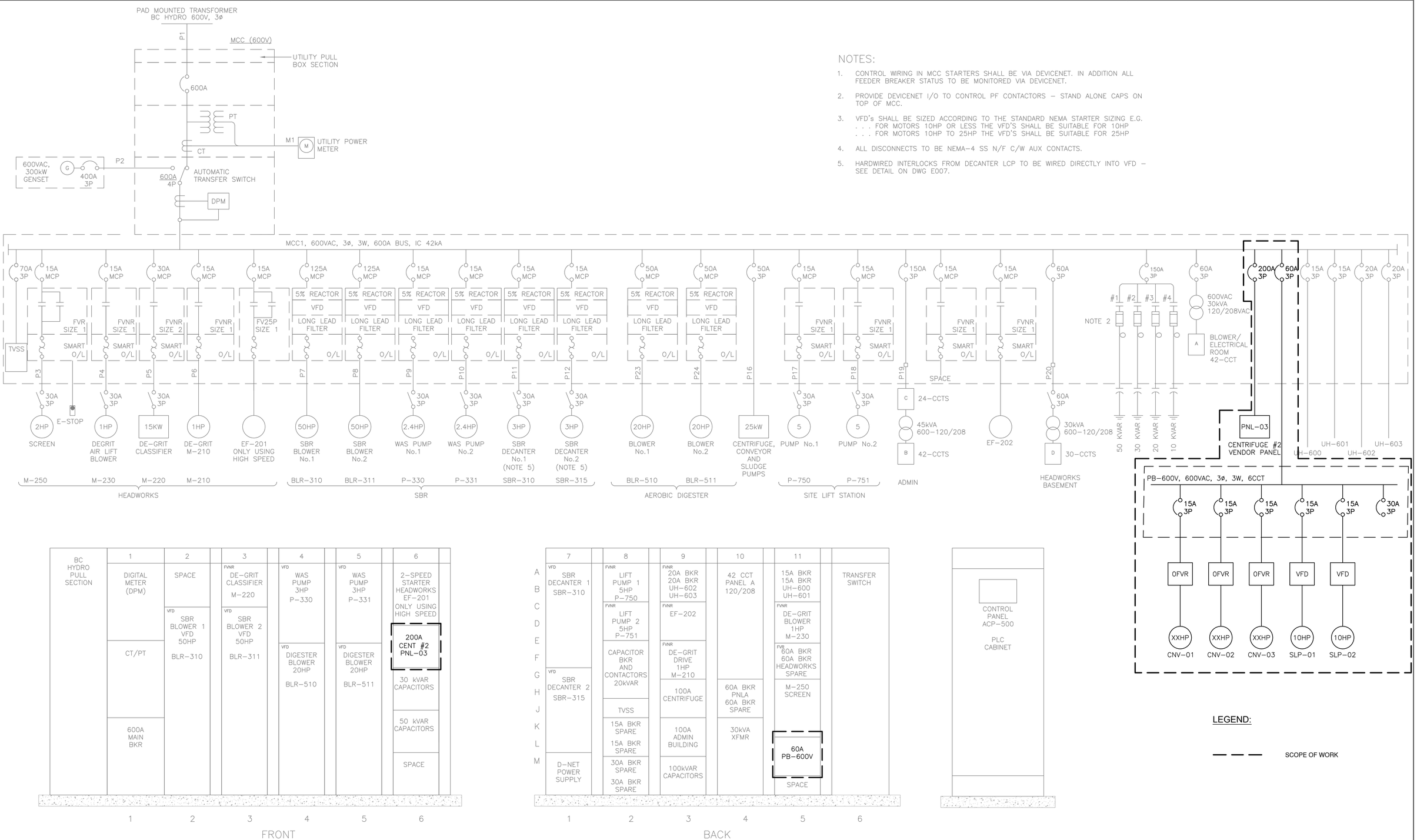
Project No. 111720015

Scale 1:50

Revision

Sheet of

Drawing No. **E-101**



NOTES:

1. CONTROL WIRING IN MCC STARTERS SHALL BE VIA DEVICENET. IN ADDITION ALL FEEDER BREAKER STATUS TO BE MONITORED VIA DEVICENET.
2. PROVIDE DEVICENET I/O TO CONTROL PF CONTACTORS – STAND ALONE CAPS ON TOP OF MCC.
3. VFD's SHALL BE SIZED ACCORDING TO THE STANDARD NEMA STARTER SIZING E.G.
   . . . FOR MOTORS 10HP OR LESS THE VFD'S SHALL BE SUITABLE FOR 10HP
   . . . FOR MOTORS 10HP TO 25HP THE VFD'S SHALL BE SUITABLE FOR 25HP
4. ALL DISCONNECTS TO BE NEMA-4 SS N/F C/W AUX CONTACTS.
5. HARDWIRED INTERLOCKS FROM DECANTER LCP TO BE WIRED DIRECTLY INTO VFD – SEE DETAIL ON DWG E007.

MCC1 SECTION LAYOUT

N.T.S.

MCC1 SECTION LAYOUT

N.T.S.

LEGEND:

— — — SCOPE OF WORK

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	RPH	SAL	2020.07.07

Issued

Permit/Seal

Consultant

Stantec

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project

District of Sooke

WWTP UPGRADES 2020

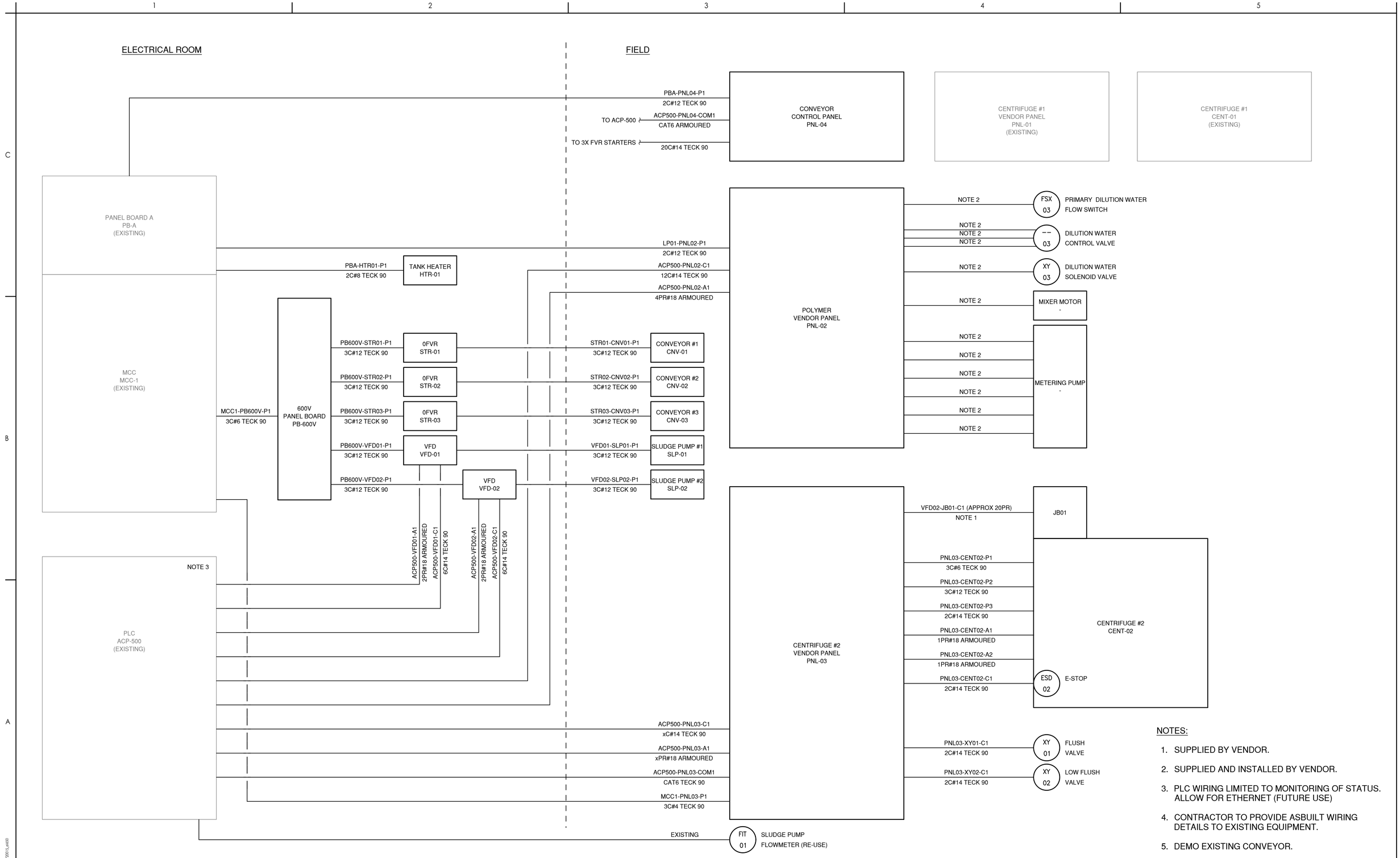
Sooke BC

File Name: 111720015_E601	RPH	RPH	SAL	
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Title

SINGLE LINE DIAGRAM & MCC LAYOUT

Project No.	Scale
111720015	NO SCALE
Revision	Sheet of
	Drawing No. E-601



NOTES:

1. SUPPLIED BY VENDOR.
2. SUPPLIED AND INSTALLED BY VENDOR.
3. PLC WIRING LIMITED TO MONITORING OF STATUS. ALLOW FOR ETHERNET (FUTURE USE)
4. CONTRACTOR TO PROVIDE ASBUILT WIRING DETAILS TO EXISTING EQUIPMENT.
5. DEMO EXISTING CONVEYOR.

Revision	By	Appd	YYYY.MM.DD
1 FOR TENDER	RPH	SL	2020.07.07
Issued	By	Appd	YYYY.MM.DD

Permit/Seal

Consultant

Stantec
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria BC V9A 6X5
Tel: 250.388.9161
www.stantec.com

Client/Project Logo

District of Sooke

Client/Project
District of Sooke

WWTP UPGRADES 2020

Sooke BC

File Name: 111720015_EI650 | RPH Dwn. | RPH Dsgn. | SAL Chkd. | YYYY.MM.DD

Title
BLOCK DIAGRAM

Project No. 111720015
Scale NO SCALE
Revision
Sheet of
Drawing No. **EI-650**

DISTRICT OF SOOKE

REQUEST FOR TENDER
TENDER 1790-20-WWTP-002

SUPPLY AND DELIVERY OF DEWATERING EQUIPMENT

DISTRICT OF SOOKE WWTP UPGRADES 2019

June 7th, 2019

The District of Sooke invites qualified Tenders for the supply, delivery, start-up and commissioning of a new decanting centrifuge and related equipment for incorporation into the District of Sooke WWTP Upgrades 2019 in the District of Sooke, BC. The tender consists of the supply, start-up and commissioning and delivery of a new decanting centrifuge and polymer injection system and accessories as herein specified.

The Tender is available electronically by downloading from BC Bid's website.

A hard copy of the Tender Package is available for viewing, upon request, from 8:30 a.m. to 4:30 p.m., Monday to Friday at District of Sooke Municipal Hall, 2205 Otter Point Road, Sooke. Electronic copies are available on BC Bid.

Tenders are scheduled to close at:

Tender Closing Time:	**2:00 p.m. Local Time**
Tender Closing Date:	**Friday June 28, 2019** *There will NOT be a Public Opening for this Tender*
Delivered to:	District of Sooke 2205 Otter Point Road Sooke, British Columbia V9Z 1J2 ATTN: Rob Howat, Director of Development Services
Tender Enquiries:	Stan Spencer, P.Eng., Stantec Consulting Ltd. Telephone: 250.389.2376 Email: stan.spencer@stantec.com

DISTRICT OF SOOKE

RECEIPT CONFIRMATION FORM

REQUEST FOR TENDER
TENDER 1790-20-WWTP-002

SUPPLY AND DELIVERY OF DEWATERING EQUIPMENT

DISTRICT OF SOOKE WWTP UPGRADES 2019

As receipt of this document, ***and*** to directly receive any further information about this Request for Tender, please return this form to:

Attention: Stan Spencer, P.Eng.
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria, BC V9A 6X5
Fax: 250.382.0514
Email: stan.spencer@stantec.com

Company Name: _____

Address: _____

District: _____

Province/State: _____ Postal/Zip Code: _____

Telephone No: _____ Fax No: _____

Contact Person: _____

Title: _____

Email: _____

Part 1 **Invitation**

1.1 **INVITATION TO TENDER**

The District of Sooke (the "District") invites Tenders from qualified Tenderers for the supply, delivery, start-up and commissioning of a decanting centrifuge and related equipment.

1.2 **SCOPE OF SUPPLY AND DESCRIPTION OF GOODS**

.1 The supply, delivery, start-up and commissioning of dewatering equipment for incorporation into the District of Sooke WWTP Upgrades 2019 in Sooke, BC. This consists of the following.

.1 Supply of a 30 m^3/hour decanting centrifuge for dewatering aerobically digested SBR waste activated sludge at the Sooke Wastewater Treatment Plant in Sooke, British Columbia.

.2 Supply of a polymer solution preparation and blending system compatible with the proposed decanting centrifuge.

.3 Supply of two (2) progressive cavity sludge feed pumps compatible with the proposed decanting centrifuge.

.4 Supply of an integrated Programmable Logic Control (PLC) system for the control and operation of the new decanting centrifuge, the existing centrifuge, polymer preparation and blending system, sludge feed pumps and dewatered cake screw conveyors (3 total).

.5 Installation support services.

.6 Testing, start-up and commissioning support services

.2 This tender consists of the supply, delivery, start-up and commissioning of a dewatering centrifuge and related equipment, as detailed on the drawings and in the specifications (the "Goods").

.3 Delivery Point: Sooke Waste Treatment Facility, V9Z 0S2.

1.3 **TENDER SUBMISSION**

.1 Tenders will be received at the specified physical location referred to below no later than ("Tender Closing"):

Rob Howat, Director of Development Services
District of Sooke
2205 Otter Point Road
Sooke, British Columbia
V9Z 1J2

Tender Closing Time: **2:00 p.m. local time**
Tender Closing Date: **Friday June 28, 2019**

There will NOT be a public opening for this Request for Tender

.2 The Tenderer must submit to the District all the completed and executed documentation in a sealed envelope or package including all attachments and enclosures, on the exterior of which should be indicated the name of the Tenderer.

.3 The time of Tender Closing shall be established by the time shown on the clock for local area network at the closing location.

.4 Tenders received after the Tender Closing\, Clause 1.3.1 will not be considered by the District and will be returned unopened to the Tenderer.

.5 No oral or electronically transmitted Tenders or amendments to Tenders will be considered.

.6 By submitting a Tender, the Tenderer agrees that it shall be solely responsible for any and all costs and expenses incurred by it in preparing and submitting its Tender, including any costs incurred by the Tenderer after the Tender Closing.

.7 Defined terms in the Tender Documents shall have the same meanings as set out in Clause 1.1 of the General Conditions Section 00 50 00, except where the contrary is expressed.

.8 Tenderers are requested to return the enclosed Receipt Confirmation Form within two working days of receipt.

Part 2 Tender Documents

2.1 An electronic version of the Tender Documents is available on BC Bid.

2.2 The District's language in its procurement documents shall be English.

Part 3 Tender Enquiries and Addenda

3.1 Enquiries should be addressed to the Contact Person: Stantec Consulting Ltd.
Stan Spencer, P.Eng.
Telephone: 250.389.2545
Email: stan.spencer@stantec.com

3.2 Any requests for explanations, interpretations or clarifications made by Tenderers should be submitted in writing to the individual named in Section 00 10 00, clause 1.3.1 at least three (3) business days before Tender Closing.

3.3 Explanations, interpretations, or clarifications may be made in the form of Addenda. All Addenda issued by the District shall be incorporated into and become part of the Tender Documents.

3.4 Addenda may be issued by the District before Tender Closing and will be distributed via e-mail by the contact person to all who have provided a completed Receipt Confirmation Form.

3.5 The Tenderer must carefully examine the Contract Documents and the site of the proposed works and the Delivery Point, judging for and satisfying themselves as to the probable conditions to be encountered. Should a Tenderer find omissions from or discrepancies in the Contract Documents, or be in doubt as their meaning, the Tenderer should notify the contact person no later than 5 days prior to the tender closing, who may cause to send a written instruction to all Tenderers in the form of an addendum, which shall become part of the contract and shall be covered in the contract price. The Tenderer may not claim, after the submission of a tender, that there was any misunderstanding with respect to the conditions imposed by the documents.

3.6 No oral interpretations made to a Tenderer as to the meaning of the Contract Documents shall be considered binding. Every request for an interpretation shall be made in writing, forwarded to the Contact Person referred to in paragraph 3.1.

Part 4 Inspection of Delivery Point

4.1 The submission of a Tender by the Tenderer shall be deemed to be an acknowledgement that the Tenderer has relied and is relying on its own examination of the Delivery Point and all other matters related to the completion of delivery.

Part 5 Completion of Tender Documents

5.1 The Tenderer shall complete the Tender Form in ink or in type.

5.2 The quantities stated herein are estimates only and are given for the purpose of providing a uniform basis for the comparison of tenders. Payment will be based on actual quantities.

5.3 All prices are to be in Canadian currency, unless otherwise stated. Prices shall be shown for each unit specified and shall include all necessary costs including but not limited to supply, fabrication and finishing, conveyance and delivery, packing, crating, freight, cartage, shipping charges, drafting charges, overhead, profit and all tariffs, duties and taxes, including Provincial Sales Tax. The applicable Goods and Services Tax (GST) shall be shown as a separate item in the tender price.

Part 6 Solicitation

6.1 The Tenderer may not make any representations or solicitations to any council member, officer or employee of the District with respect to the Tender either before or after submission of the Tender except as provided herein. If any director, officer, employee, agent sub- contractor, supplier or other representative of the Tenderer communicates with any council member, officer or employee of the District or any consultant engaged by the District in connection with this Invitation to Tender about this Invitation to Tender, other than the Contact Person named under Part 3 – Pre-Tender Enquiries and Addenda, the District may, regardless of the nature of the communication, reject the Tender submitted by the Tenderer.

Part 7 Submission of Tenders

7.1 The Tenderer must submit the following completed and executed documentation:

.1 Tender Form Sections 00 20 00, 00 40 00, 00 52 10;

.2 A security ("Bid Security") in the form of 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 in an amount equal to 10% of the Tender price;

.3 In a sealed envelope or package, on the exterior of which should be indicated the Tender Number and the name of the Tenderer.

.4 The Tender shall be submitted no later than the Tender Closing at the following specified physical location set out in Section 00 10 00 Clause 1.3.1.

7.2 No oral or electronically transmitted Tenders or amendments to Tenders will be considered.

7.3 It is solely the responsibility of the Tenderer to ensure that it has obtained, prior to the Tender Closing, all Addenda issued by the District.

7.4 The District will not accept an amendment to a previously submitted Tender unless:

.1 it is in writing;

.2 it is received at the specific physical location set out in Section 00 10 00, Clause 1.3.1, prior to the Tender Closing in a sealed envelope or package on the exterior of which should be indicated the Tender Number and the name of the Tenderer;

.3 it indicates a change to a Tender already submitted; and

.4 it is signed and the amendment indicates that the person who signed is an authorized signatory of the Tenderer.

7.5 It is solely the responsibility of the Tenderer to ensure that its Tender and any amendments are received at the specific physical location set out in Section 00 10 00, Clause 1.3.1.

7.6 Tenderers shall be solely responsible for the completion and delivery of Tenders and any amendments in the manner and time specified by Section 00 10 00, Part 8.

7.7 Tender form must be signed by an authorized signatory of the Tenderer.

7.8 Tenderer must acknowledge receipt of all Addenda.

Part 8 Withdrawal of Tenders

8.1 A Tenderer may withdraw its Tender after it has been submitted to the District, provided the request for withdrawal is made in writing, signed by an authorized signatory for the Tenderer, delivered (not mailed) to the office referred to in Section 00 10 00, Clause 1.3.1 and received by the District before the time set for the Tender closing .

Part 9 Irrevocability of Offer

9.1 The Tender submitted by the Tenderer shall be irrevocable and remain open for acceptance by the District for a period of 120 business days from the Tender Closing, whether another Tender has been accepted or not.

9.2 If a Tenderer, for any reason whatsoever, purports to revoke its Tender within 120 business days from the Tender Closing, or if for any reason whatsoever a successful Tenderer does not execute and deliver the Agreements in accordance with Section 00 10 00, Clauses 12.1 and 15.1, the District, without limiting any other remedy it may have under the Tender Documents or otherwise, shall be entitled to require the Tenderer to pay to the District an amount equal to the difference between the tender price of its Tender and any other Tender which is accepted by the District, if such other Tender is for a greater price, plus the total of all costs, expenses and damages, including legal fees on a solicitor and own client basis, incurred by the District as a result of or related to such revocation or failure by the Tenderer.

Part 10 Acceptance and Rejection of Tenders

10.1 Notwithstanding any other provision in the Tender Documents, any practice or custom in the industry, or the procedures and guidelines recommended for use on publicly funded projects, the District, in its sole discretion, shall have the unfettered right to:

.1 accept any Tender;

.2 reject any Tender;

.3 reject all Tenders;

.4 accept a Tender which is not the lowest Tender;

.5 reject a Tender even if it is the only Tender received by the District;

.6 accept all or any part of a Tender; and

.7 award all or a portion of the contract to supply the Goods to any Tenderer.

10.2 If a Tender contains a defect or fails in some way to comply with any of the requirements of the Tender Documents, including where such non-compliance is material, the District may, in the sole and unfettered discretion of the District, waive the defect or non-compliance and accept the Tender.

10.3 The District will notify the successful Tenderer in writing that its Tender has been accepted (the "Notice of Award") as well as notifying, in writing, the unsuccessful Tenderers.

10.4 Acceptance of any Tender may be subject to budgetary considerations and District of Sooke Council approval.

10.5 If the Form of Tender requires unit prices for optional items, the District may, in its sole discretion, compare Tenders with and without pricing for all or any such optional items and may accept a Tender with some, all or none of such optional items.

Part 11 Successful Tenderer Requirements

11.1 The successful Tenderer shall execute and deliver the Agreement in the form set out in Sections 00 40 00 and 00 52 10, in triplicate, to the District within ten (10) Days after it has received the Agreement from the District.

11.2 The successful Tenderer shall submit to the District the following original documentation within seven (7) Days of receiving the Notice of Award;

.1 An original certificate of insurance pursuant to Section 00 50 00, Clause 5.2, in a form acceptable to the District.

.2 Performance Bond in the amount of 50% of the Contract value.

Part 12 Confidentiality and Security

12.1 The following conditions apply:

.1 The Tender Documents, or any portion thereof, may not be used for any purpose other than submission of Tenders; and

.2 If a Tenderer considers that any part of their Tender is confidential, they shall indicate this their Tender. Tenderers should be aware, however, that pursuant to section 21 of the *Freedom of Information and Protection of Privacy Act*, the District may be required to disclose such information, even though it is expressed to be confidential, pursuant to a request for information made under that Act. Tenderers are advised to review that Act.

Part 13 Disclaimers/Limitations of Liability

13.1 The District, its council members, officers, servants, employees and agents expressly disclaim any duty of care and all liability for representations, warranties, express or implied or contained in, or for omissions from this Request for Tender or any written or oral information transmitted or made available at any time to a Tenderer by or on behalf of the District. Nothing in this Request for Tender is intended to relieve a Tenderer from forming its own opinions and conclusions in respect of this Request for Tender, and the Tenderer hereby waives for itself, its successors, heirs and executors, the right to sue the District in tort for any loss, including economic loss, damage, cost or expense arising from or connected with any error, omission or misrepresentation occurring in the preparation of Tender and the Contract Documents.

13.2 No Tenderer shall have any claim for any compensation of any kind whatsoever, as a result of participating in this Request for Tender, and by submitting a Tender each Tenderer shall be deemed to have agreed that it has no claim.

Part 14 **Novation Agreement**

14.1 It is a condition of the Supply Contract that the Supplier enters into a Novation Agreement, annexed hereto in Section 00 52 10 as Appendix "A", with the General Contractor selected by the District, and the District.

END OF SECTION

TENDER FORM

Contract: SUPPLY AND DELIVERY OF DEWATERING EQUIPMENT

1. I (WE), THE UNDERSIGNED:

have received and carefully reviewed all of the Contract Documents, including the Instructions to Tenderers, and the following Addenda which form a part of this tender:

_____

_____

_____

(Addenda, if any) (Tenderer to Complete)

2. TENDER DOCUMENTS

2.1 The Tender Documents for this Contract include the following:

a. All documents listed in Section 00 10 00, Table of Contents;

b. Drawings: Issued for Equipment Pre-purchase

c. Addenda as issued.

3. TENDERERS OFFER

3.1 The Tenderer hereby offers to perform and complete all of the Work and to supply all the plant, material, equipment, labour and workmanship, and to do everything further necessary, as set out in the Contract Documents for the fulfillment of **TENDER** for the **SUPPLY AND DELIVERY OF DEWATERING EQUIPMENT** to the **DISTRICT OF SOOKE** on the terms and conditions therein contained and within the time specified limited and for the amounts set out in the completed schedule of unit prices (Schedule 1 - Quantities and Prices).

4. TENDERERS DECLARATIONS

4.1 The Tenderer declares that it has read and understood and agrees to be bound by the Tender Documents.

4.2 Without limiting the generality of Section 00 20 00, Clause 4.1, the Tenderer declares that it has fulfilled and complied with all of those obligations and requirements under the Tender Documents which are required to be fulfilled by the Tender Closing.

4.3 The Tenderer confirms, represents and warrants that all information which it has provided to the District is true and accurate in every respect.

5. SCHEDULES

5.1 The immediately following Schedules, namely:

Schedule 1 - Quantities and Prices
Schedule 2 - Supply and Delivery Dates
Schedule 3 – Maintenance and Support

shall form part of the Tender Documents. The Tenderer shall complete the Schedules and submit per Section 00 10 00, Clause 8.1.

5.2 The information contained in the Schedules may be used by the District to assess the Tenderers ability to perform the Contract and may be taken into account by the District in its decision to award the Contract.

5.3 All prices shall be shown in Canadian currency.

SCHEDULE 1 – QUANTITIES AND PRICES

The Tenderer hereby submits unit prices as required by the specifications and agrees that these prices will be used for payment for the Goods including Goods additional to and deleted from the Contract and agrees that the prices quoted shall remain in force until the date of completion of the Contract.

The Tenderer confirms that the tender price, including any unit prices, include all necessary costs including but not limited to supply, fabrication and finishing, conveyance and delivery to the Delivery Point, packing, crating, freight, cartage, shipping charges, drafting charges, overhead, profit and all tariffs, customs, duties and taxes, including provincial sales tax, with the exception of GST which shall be shown separately.

The total of the unit prices plus the applicable GST shall agree with the total tender price.

SCHEDULE 1 – QUANTITIES AND PRICES

Item	Description	Qty	Unit	Unit Price ($)	Total Price ($)
1	Supply and delivery of Dewatering Centrifuge and full dewatering system PLC summarized in Section 46 76 00 drawings as part of this Tender package.	1	LS	$	$
2	Supply and delivery of Dewatering Centrifuge feed pumps summarized in Section 43 23 85 and drawings as part of this Tender package.	2	LS	$	$
3	Supply and delivery of Polymer System package summarized in Section 46 80 00 and drawings as part of this Tender package.	1	LS	$	$
4	Shop drawing submittal Not to exceed 10% of items 1 to 5	1	LS	$	$
5	Startup, commissioning and training of supplied equipment. Assume 5 days/ 1 trip Not to exceed 10% of items 1 to 5	1	LS	$	$
7	Optional[1] : Annual service Contract (5 year term)[2]	year	$/year	**$**	**$**
				GST (5%) of total	$
				Total	$

[1] The tender assessment is based on the total price of items 1 to 5. However, optional items will only become a part of the contract upon written notice from the Contract Administrator. No claims for lost profit will be allowed from any tenderer if the optional items do not become part of the contract.

[2] A Service Contract Agreement is provided in Schedule 4.

The tender price stated above will be used to compare submitted Tenders. The District reserves the right to check the above extensions and additions and to make corrections as necessary.

The unit prices will govern payments for the Goods of the resulting Contract.

PAYMENT TERMS

Refer to Section 01 27 00 Measurement and Payment, Clause 1.4 Progress Payments, for a description on how payments will be made.

SCHEDULE 2 – SUPPLY AND DELIVERY DATES

1. The Tenderer shall complete the following Schedule of Supply and Delivery Dates for the Goods and shall be prepared to supply the Goods to the Delivery Point no later than the date shown on Table 1 below. The Schedule of Supply and Delivery should be the Tenderers best realistic delivery date.

2. It is the intent of the Contract that the Goods, including all main equipment, ancillaries, accessories and any tools, be supplied as completely assembled as practical. If it is the intent of the Tenderer to supply any Goods, accessories and tools in components or not completely assembled, the Tenderer should indicate the separate components or provide a description of the state of assembly for each type of equipment.

3. Final schedule is ultimately determined by the General Contractor responsible for delivering the construction contract; however, Supply Contractor shall be prepared to deliver materials as required to site by the date indicated in Table 1 below.

4. The project intent is to have the construction completed by the end of March 31st, 2020.

5. Table 1 – Supply and Delivery Dates

   In response to the District's preferred delivery dates, the Tenderer offers its best delivery schedule as follows:

TABLE 1 – SUPPLY AND DELIVERY DATES

Item	**Description**	**Tender's Proposed Delivery Date**	**The District's Preferred Delivery Date Schedule**
1	Complete Shop Drawings Weeks following Notice to Proceed		4 weeks
2	Equipment Delivered to Site Weeks following completion of Shop Drawing Review		26 weeks

SCHEDULE 3 – MAINTENANCE AND SUPPORT

The Tenderer shall complete the following Schedule of Maintenance and Support for the Goods. The following are the minimum requirements of the Supplier:

- Shall provide a 24 hour, 365 day toll free service hotline
- Next day Service Technician (experienced with Manufacturer's complete system)
- Same day or overnight parts availability

SCHEDULE 3 – MAINTENANCE AND SUPPORT

Item	**Description**	**Suppliers Availability**
1	Toll free service Hotline hours and days per year	_____ hours, _____ days a year
2	Technician Availability	Same day / overnight/ other (describe)
3	Part availability (including rectifier and electrolytic cells)	Same day / overnight/ other (describe)
4	Local Service Provider	Company: Years' Experience with Manufacturers Equipment: Local Address:

SCHEDULE 4 – XXX CENTRIFUGE SERVICE AND MAINTENANCE AGREEMENT

This Service and Maintenance Agreement, dated as of XXXX XX, 2020, between **XXXXXXXXXXXXXXXXXXXX** (Supplier) having its principle office at XXXXXXXXXXXX, XXXXXXXXXXXXXXXX and **District of Sooke**. (Owner) having its principle office at 2205 Otter Point Road, Sooke, British Columbia V9Z 1J2.

In consideration of the mutual covenants herein contained, Supplier and Owner hereby agree to enter into an extended Preventive Maintenance Agreement for a **period of 5 years or completion of 15,000-hours service**. This Agreement incorporates the attached Exhibits 1, 2, 3 and 4.

1. Scope of Work

Supplier agrees to provide a Factory Technician to conduct preventative maintenance on the Owner's Centrifuge based on the attached Scope of Work (Exhibit 2) and Preventative Maintenance Schedule (Exhibit 3).

2. Labor, Tools and Supplies

Owner is responsible to provide additional labor, as required, and any specialized tools and lubrication fixtures. Owner will make available the use of an overhead crane where required or provide suitable lifting assembly when necessary for lifting components.

3. Manufacturer Service Contact

Supplier maintains standard business hours of 8:00 AM to 5:00 PM XT. After business hour service is provided 24 hrs/day by dialing 1-xxx-xxx-xxxx. After hours calls are distributed to on-call individuals that will respond via phone to help assess service requirements and ship parts.

4. Service Reports

At the completion of each visit, the technician will provide a report covering the details of the service provided. This will include any recommendations or observations that require future service by the Owner. Owner will be responsible to sign and date report acknowledging that he/she understands the service provided and is aware of potential service issues. A copy of this report will be sent to the Owner after it is reviewed by the Service Manager with additional comments if needed.

5. Safety Requirements

Supplier provides all technicians with basic safety equipment such as steel toe boots, safety glasses, hardhat and gloves. Owner is responsible to provide a safe working area and notify Supplier of any additional safety requirements prior to servicing equipment. If the environment is determined to be unsafe, it is the Owners responsibility to correct prior to any equipment servicing or to provide specialized safety equipment and applicable training.

6. Contract Renewal

At the expiration of the Agreement, the Owner and Supplier can mutually agree to renew said Agreement.

7. Terms and Conditions of Sale

The attached (Exhibit 4), Terms and Conditions of Sale, shall apply to this Agreement.

8. Sales and Use Tax

All applicable sales and use taxes are to be paid by the Supplier direct to the applicable tax authority.

9. Agreement Offering

Supplier offers this Agreement for a lump sum price of $XX,XXX.XX Dollars to be paid in 5 payments based upon equal payments. Year 1 through Year 5 = $X,XXX.XX each year. Payment is due prior to first visit and will initiate contract start date.

10. Entire Agreement

This Agreement contains the entire and only agreement between the parties with respect to the subject matter hereof and supersedes all prior oral and written understandings between Owner and Supplier concerning the parts and/or services specified herein, and any prior course of dealings or usage of the trade not expressly incorporated herein.

11. Representations

Each, the Supplier and Owner, represent and warrant that it has duly authorized the execution and delivery of this agreement; that this agreement as has been executed and delivered by it and that this agreement constitutes its legal, valid and binding obligation enforceable against it in accordance with its terms.

IN WITNESS WHEREOF, the parties hereto have duly executed this Service Agreement on the date first above written.

Supplier:	_____	Owner:	_____
By:	_____	By:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____

EXHIBIT 1
OWNER SUPPLIED GUIDELINES

- (1) XXX Centrifuge

- Operating 6 hrs/day, 4 days/week, but no more than 3,000 hours per year for the period of the Agreement based on the originally specified process parameters and limited to a maximum of 30,000 hours.

- Process Parameters Per Proposal:

    - Sludge Type: Aerobically Digested SBR Waste Activated Sludge
    - Hydraulic Loading: 30 m^3/hour
    - Feed Solids: 0.8% Total Solids
    - Hydraulic Loading: 30 m^3/hour
    - Solids Loading: 240 kg/hour
    - Cake Dryness: 18% +/- 2%
    - Capture 95%

- The Centrifuge will be operated by the Owner per the Manufacturer's Operating and Maintenance Manual.

EXHIBIT 2
OWNER SUPPLIED GUIDELINES
SCOPE OF WORK BY SUPPLIER AND OWNER

SUPPLIER

Supplier agrees to provide a Factory Technician to conduct service and preventative maintenance on the supplied Centrifuges. Preventative maintenance is based upon an established level of operating hours and includes scheduled inspections as well as replacement of wear components. This Agreement includes wear parts, lubricants and service for the period specified per the Preventative Maintenance Schedule (Exhibit 3).

Replacement parts other than the specific wear components listed in the Preventative Maintenance Schedule in Exhibit 3 of this Agreement are not included.

In addition to the service specified, the Factory Technician will inspect the operation, train operators, adjust programming and provide system quality control before he leaves the site after a service.

OWNER

Owner to provide basic/routine preventive maintenance. Owner to conduct minimum:

- Daily Performance Optimization
- Hours of operation
- Inspections and checking for leaks
- Daily Operator Checks
    - Centrifuge operation, vibration, abnormal noise
    - Bearing temperature and noise
    - Current consumption of drive motor
    - Change Redex Pulley break-in oil at 200 hrs of operation
    - Check torque readings
    - Check for grease leaks at cyclo unit
    - Check product leakage at pillow blocks

Owner must supply overhead or mobile crane for disassembly of the machine. Minimum load is 3 tons.

EXHIBIT 3
MAINTENANCE SCHEDULE

SCOPE OF SERVICES

Preventive Maintenance service consists of planned maintenance services which will be executed according to specifications given in the Operator Manual and the Repair Procedures for the supplied equipment.

The activities included are below indicated with an "✓".

☐ **Intermediate Service**
Executed as a service with the intervals of 3000 operating hours or 12 calendar months according to specifications.

☐ **Major Service**
Executed as a service with the intervals of 6000 operating hours or 24 calendar months according to specifications.

☐ **Gear Box Service**
Executed as part of Major Service according to specifications.

	Intermediate Service	Major Service	Gear Box Service
Rotating Parts			
Visual inspection for wear on rotating assembly, conveyor	✓	✓	
Exchange of main bearings for small and large end hub, conveyor bearings		✓	
Bearing noise main motor / back drive motor	✓	✓	
Seal rings, O-rings exchange	✓	✓	
Check wear of discharge bushing, discharge saddle	✓	✓	
Cleaning of polymer zone, feed zone for blockages	✓	✓	
Inspection of all screws & their mating threads for damage, stress		✓	
Inspection of Protective tube, Feed tube and V-belts	✓	✓	
Inspection of Lubricating nipples and passages, GS coupling		✓	
Hydraulics (if applicable)			
Exchange of oil filter and oil	✓	✓	
Inspection of oil level	✓	✓	
Stationary Parts			
Inspection of foundation, frame, cover, vibration dampers, casing lower part, inlet pipe, torque arm switch	✓	✓	
Check whether ventilation is open at both ends	✓	✓	
Wear check of bowl bearing housing, small end hub, bowl bearing housing, large end hub		✓	

Inspection of vibration dampers, vibration motor (if applicable)		✓	
Lubrication of all bearings	✓	✓	
Other			
Inspection of Brake, main electrical motor (back drive motor)		✓	
Performance review of centrifuge with Operators and recommendation of Operation Optimization	✓	✓	
Check points and vibration test			
Tiles, hard surfacing	✓	✓	
Operation dry – wet & production (if available)		✓	
Pt-100 check on main bearings, dry – wet & production		✓	
Vibration analysis of all rotating elements	✓	✓	
Measurement of torque back drive motor – dry – wet & production		✓	
Overload device, working test		✓	
Hydraulics idle, production (if applicable)		✓	
Working test of vibration sensor, Emergency stop		✓	
Gear box			
Check Oil level and change of oil if required			✓
Only valid for direct drive Gear Boxes: Change of Gear Box lip seals and Sun wheel shaft bearings - At Major Service, or if needed			✓
Only valid for planetary Gear Boxes: Change of Gear Box lip seals and wheel shaft bearings - At a Major Service, after 3 years of operation			✓

A formal handover of the equipment, from the Customer to the Supplier, shall be done before any work starts.

After the service is executed the Supplier will hand over the Equipment to the Customer by hand over a signed Service report on site with maintenance remarks and recommendations, including status of the equipment, actions undertaken during the visit and indication of future actions from both sides. If further remarks or recommendations are needed, it will be sent to the Customer latest 14 days after the last service day. The customer is expected to witness the proper function of the decanter during the test run.

The spare parts required and undertaken within this Agreement are as follows:

Part Number	Description	Quantity per visit
XXXXXX-XX	Intermediate Service Kit Main Bearings	X
XXXXXX-XX	Intermediate Service Kit Conveyor Bearings	X
XXXXXX-XX	Major Service Kit Main Bearings	X
XXXXXX-XX	Major Service Kit Conveyor Bearings	X
Only included if the decanter has a planetary gear box and if “Gear Box Service” is selected		

XXXXXX-XX	Ball Bearing	X
XXXXXX-XX	Lip Seal	X
XXXXXX-XX	O- Ring	X
Only included if the decanter has a direct drive gear box and if "Gear Box Service" is selected		
XXXXXX-XX	Sun wheel shaft Service kit	X

During this service, if the Service Technician deems that further spare parts or repair work is required, the Customer will be informed so as to decide the necessary course of action.

SERVICE AND EQUIPMENT ACCESSABILITY

Expected total down time of the equipment is X hours for the Intermediate Service and X hours for the major Service, after that the Supplier has access to the Equipment. The Customer shall ensure that the Supplier has access to the Equipment at the agreed or notified time for the service described in this Appendix.

Cleaning of the decanter parts is expected to be provided and done with assistance from customer staff.

WORKING HOURS

Unless otherwise agreed, the service shall be carried out during the Supplier's normal working hours, 8 hour per weekday. Any time worked over 8 hours will be invoiced at Supplier's normal overtime rates.

LUBRICATIONS AND CLEANING AGENTS

If the Customer provides the Supplier's recommend lubricants, it should be accessible for the Supplier in advance of the service and stored in accordance with the manufacture's instruction.
The Customer undertake the disposal of used lubricants and cleaning agent if nothing else is agreed upon by both parties.

MINIMUM REQUIREMENTS

To be able for the Supplier to perform the Services, the Customer shall provide the Supplier with following information:

- Equipment documentation
- Maintenance history (for maintenance not done by Alfa Laval Service)
- Specific Customer log sheets

EXCLUSIONS

Control Panel Electrical components replacement cost are not included as part of the service agreement. Supplier will assist in establishing required replacement components, installation and programming as required to return the equipment to operation. The cost to travel to the site to install replacement components and return the equipment to operation is not included in this Maintenance Agreement.

All goods and services - that are not explicitly included in and covered by the charges are excluded there from and shall be invoiced and paid for separately.

EXHIBIT 4
TERMS AND CONDITIONS

Part 1 **General**

In this Service and Maintenance Agreement, Conditions, the term "Agreement" means the Service and Maintenance Agreement and all appendices attached thereto and "General Conditions" means the general conditions attached to the Service and Maintenance Agreement.

Part 2 **Delays**

2.1 **Supplier's delay**

If the Supplier fails to carry out the Services, or deliver parts, at the agreed time and such delay is not due to circumstances on the part of the Customer or Force Majeure as defined in Section 6, the following shall apply: (a) In case of delays in the Services the Customer shall fix a final period within which the Supplier shall have carried out the Services and if the Supplier has not carried out the Services within this time the Customer may carry out the Services himself or employ others to do so, in which case the Supplier shall reimburse the Customer for any additional costs incurred by the Customer for such Services and repay to the Customer an amount corresponding to the Services in question not performed by the Supplier; and (b) In case of delays in delivery of parts the terms and conditions of the General Condition shall apply.

2.2 **Customer's delay**

The Customer shall without delay notify the Supplier if he cannot let the Supplier carry out the Services or take delivery of parts or the repaired Equipment or parts thereof at the agreed time. The Supplier's prices are calculated on the basis of the Customer fulfilling its obligations specified in the Agreement. In case the Supplier is prevented from performing the Services and making deliveries due to the Customer's failure to fulfil its obligations, the Customer shall reimburse the Supplier for the extra costs incurred by the Supplier as a result thereof, including but not limited to waiting costs, extra work, travel and lodging costs and storage costs.

Part 3 **Liability for defects and limitation of liability**

3.1 **Liability for Services**

The Supplier shall perform the Services in accordance with the provisions of this Agreement and with the skill and care required by customarily accepted good professional and technical practices and which the Customer has reason to expect of Supplier.

The Supplier shall re-perform any services that are not in conformity with the required degree of skill and care as stated above, provided that the Customer notifies the Supplier of any alleged deficiency within 30 days after handing-over. Such re-performance of services is the Customer's sole and exclusive remedy for services that fail to meet the foregoing standards

The Supplier's liability for defects in performed Services is limited to defects which appear within a period of three (3) months from the performance of the Services and is limited for parts used in performed Services only.

The Customer shall without undue delay notify the Supplier in writing if the Customer becomes aware that the Services are defective. If the Customer fails to give notice without undue delay it shall lose its rights in respect of the defect, except where the defect is such that it should have been apparent to the Supplier.

If the Supplier fails to fulfil its obligations under the aforementioned paragraphs of this Section 3.1 within a reasonable time, the Customer may, after having notified the Supplier thereof in writing, undertake itself or employ a third party to undertake necessary remedial work at the risk and expense of the Supplier, provided that the Customer proceeds in a reasonable manner not exceeded 2% of the current yearly contractual value.

If defects in the Services risk causing damage, the Customer shall take any immediate measures, which are necessary to prevent or mitigate such damage. The Supplier shall reimburse the Customer for the necessary costs incurred by the Customer when undertaking such measures.

3.2 **Liability for Parts**

The defects liability period on each part is twelve (12) months after its shipment. Notwithstanding the foregoing the Supplier assumes no liability for defects in supplied wear and tear parts.

3.3 **Limitation of liability**

The Supplier's liability under Section 3 above does not cover defects or damage due to circumstances out of the Supplier's control or circumstances for which the Supplier otherwise cannot reasonably be held responsible, such as incorrect operation or the Customer's Equipment, incorrect care or faulty maintenance by the Customer. From the Supplier's liability is furthermore excluded the spare parts replaced on equipment which have been modified or repaired without the Supplier's prior written consent.

The Supplier shall have no liability for defective Services, works or parts or otherwise for its negligence except as stated in this Service and Maintenance Agreement Conditions and the General Conditions.

In no event shall the Supplier be liable for any special, indirect or consequential damages or losses or purely financial losses of any kind such as, but not limited to, loss of revenue, loss of use, loss of production, costs of capital or costs connected with or arising out of the Supplier's performance or failure to perform any of its obligations under the Agreement. In no event whatsoever shall the Supplier's cumulative liability under or in relation to the Agreement, whether payable as damages, indemnity or under any other legal theory during a year, exceed an aggregate amount equal to fifteen (15) percent of the total price for the Services performed during that year.

The limitations of liability set forth in this Section 3 shall not apply if and to the extent any damage is caused by any grossly negligent act or omission or wilful misconduct attributable to the Supplier.

Part 4 **Termination**

Without prejudice to any remedy either party may have against the other for breach or non-performance of the Agreement, either party shall have the right to terminate the Agreement with immediate effect, if the other party should materially breach any of the provisions or conditions of the Agreement, and should fail to discontinue and make good such breach within thirty (30) days after receipt of notice in writing from the complaining party.

Without prejudice to any remedy either party may have against the other party for breach or non-performance of the Agreement, either Party shall have the right to terminate the Agreement with immediate

effect in the event of voluntary or compulsory winding-up, bankruptcy, or more generally, in the event of insolvency of the other party.

Part 5 **Confidentiality**

Each party undertakes that it shall not disclose, in whole or in part, to any third party, or use for other purposes than envisaged in the Agreement, without the other party's consent, such information made available under the Agreement regarding the other party's business operation or technology which may be considered as business or professional secrets, except to the extent necessary for the performance under the Agreement. The confidentiality undertaking shall not apply to information already in the public domain or known to the other party, or to the extent a party is required to disclose confidential information by law or regulation or pursuant to any order of court or other competent authority or tribunal.

Part 6 **Force Majeure**

Either Party shall be entitled to suspend performance of its obligations to the extent that such performance is impeded or made unreasonably onerous by Force Majeure defined as any of the following circumstances: industrial disputes and any other circumstances beyond the control of the Parties such as fire, war, extensive military mobilization, insurrection, requisition, seizure, embargo, restrictions in the use of power, currency, export or travel restrictions or sanctions, epidemics, natural disasters, extreme natural events, terrorist acts and defects or delays in deliveries by sub-contractors caused by any such circumstance referred to in this Section 6. The Party claiming to be affected by Force Majeure shall notify the other Party in writing without delay. Regardless of what might otherwise follow from the Agreement, either Party shall be entitled to terminate the Agreement by notice in writing to the other Party if performance of the Agreement is suspended under this Section 6 for more than six (6) months.

Part 7 **Amendments**

All amendments and/or additions to the Agreement shall be made in writing and duly signed by authorized representatives of both parties to be valid.

Part 8 **Assignment**

Neither Party may assign the Agreement or any of its rights thereunder without the prior written consent of the other Party.

Part 9 **Governing law**

The Agreement shall be governed by the substantive laws of British Columbia and Canada.

Part 10 **Arbitration**

Any disputes arising out of or in connection with the Agreement shall be finally settled under the Rules of Arbitration for British Columbia by one or more arbitrators appointed in accordance with the said rules.

The place of arbitration shall be British Columbia.

TENDERERS NAME

This Tender is hereby submitted by:

_____

Date

_____

Name of Tenderer (please print)

_____

_____

Address of Tenderer

_____ _____

Telephone Number of Tenderer Facsimile Number of Tenderer

_____

E-mail address of Tenderer

_____ _____

Title of Contact Print Name of Contact

_____

Signature

(the "Tenderer")

NOVATION AGREEMENT ACKNOWLEDGEMENT

The Tender agrees to join in an assignment and Novation Agreement in the form set out in Appendix A as soon as the construction contract between the District and the General Contractor has been signed.

EXECUTION BY TENDERER

This Tender is executed at_____this_____day of_____, 2019.

Print name of District or District, and Province, or if outside Canada, Country.

SIGNED

by _____
(Print Company Name)
By its authorized signatory (ies):

_____
(Signature)

_____
(Print Name and Title)

END OF SECTION

DISTRICT OF SOOKE

DISTRICT OF SOOKE WWTP UPGRADES 2019
CONTRACT 1790-20-WWTP-002

UNDERTAKING OF SURETY - PERFORMANCE BOND
[Undertaking to accompany Tender]

District of Sooke
2205 Otter Point Road
Sooke, British Columbia
V9Z 1J2

Gentlemen:

We, the undersigned

_____

(Insert Bonding Company's Name)

do hereby undertake and agree to become bound to District of Sooke for a PERFORMANCE BOND for

_____DOLLARS ($_____)
(Insert a Sum Equal to 50 Percent of the Total Tendered Amount)

for the fulfilment of the Contract to perform the works and services, all as specified in the attached Tender Form if the Contract is awarded to

_____.
(Insert Tenderer's Name)

Dated at_____, British Columbia, this_____day of_____,2019.

Yours very truly,

_____
Signature and Corporate Seal of Surety Company Licensed to Conduct Business in the Province of British Columbia

DRAFT CONTRACT AGREEMENT

THIS AGREEMENT made this_____day of_____, 2019.

BETWEEN: _____(the "Supply Contractor")

AND: District of Sooke (the "District")

THIS AGREEMENT WITNESSES that the Supply Contractor and the District agree as follows:

1. The Supply Contractor shall provide all labour, materials, equipment, supplies and all other items required to supply the Goods and perform all other Work within the required time, as required by the Contract Documents.

2. The District shall pay the Supply Contractor the Contract Price, as required by the Contract Documents.

3. The Contract Price shall be the sum in Canadian Dollars of the following:

   .1 the tender price, as set out Section 00 20 00, and

   .2 any payments made on account of changes, as may be required by the Contract Documents.

   The Contract Price shall be the entire compensation payable to the Supply Contractor by the District for the Goods other Work and shall cover and include necessary costs including but not limited to all supervision, labour, materials, equipment, supplies and all other items, overhead, profit, financing costs, duty, shipping charges, fabrication and finishing, storage as required, conveyance and delivery, packing, crating, freight, cartage, drafting charges, tariffs, warranty and all other costs and expenses whatsoever incurred in performing the Contract.

4. The Supply Contractor shall supply all Goods to the Delivery Point no later than the dates shown on Section 00 20 00 Schedule 2, including revisions under Section 00 50 00, Item 7.1.2, if any.

5. The Contract Documents shall form a part of this Agreement.

6. The Contract supersedes all prior negotiations, representations or agreements, whether written or oral and is the entire agreement between the District and the Supply Contractor with respect to the subject matter of this Agreement.

Capitalized terms in this Agreement shall have the meanings as set out in Section 00 50 00, Clause 1.1.

7. The Supply Contractor shall not assign the Contract, or any portion of the Contract, or any payments due or to become due under the Contract, without the express written consent of the District.

8. No action or failure to act by the District or an authorized representative of the District shall constitute a waiver of any right or duty afforded any of them under the Contract or constitute an approval or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

9. This Agreement shall enure to the benefit of and be binding upon the District and the Supply Contractor and their respective heirs, executors, legal representatives, successors and permitted assigns. In the event of more than one person being the Supply Contractor, such persons shall be jointly and severally liable for all of the representations, warranties, covenants and obligations of the Supply Contractor under the Contract.

10. Time shall be of the essence of this Agreement.

11. This Agreement is governed by the laws of British Columbia, Canada.

12. This Contract Agreement will be assigned to the General Contractor once that contract is awarded. (Estimated to be by late 2019).

IN WITNESS WHEREOF the parties hereto have executed this Agreement as follows:

DISTRICT OF SOOKE

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

Part 1 **General**

1.1 **DEFINITIONS**

.1 The following words and terms, unless the context otherwise requires, in all Contract Documents, shall have the meanings set out below.

"Addenda" means any and all addenda issued by the District;

"Agreement" means the agreement set out in Section 00 40 00;

"Construction Contract" means the agreement between the District and the General Contractor who is to install the Goods supplied pursuant to the Contract;

"Contract" means the agreement formed by the District's acceptance of the Tender for completion of the work set out in the Contract Documents;

"Contract Documents" means the following documents:

.1 the Tender Documents
.2 the executed Tender Form
.3 the executed Bonds, if any,
.4 the executed Agreement
.5 the General Conditions
.6 Drawings, if any
.7 Specifications
.8 Change orders
.9 Addenda
.10 other relevant documents such as but not limited to letters of clarification and any reports, standards or the like included by reference;

"Contract Price" has the meaning set out in Section 00 40 00 Clause 3;

"Day" means calendar day;

“Delivery Date” has the meaning set out in Section 00 20 00 Schedule 2;

“Delivery Point” means the location set out in Section 00 10 00 Clause 1.2.3;

"Drawings" means the drawings included in the Tender Documents together with those prepared by the District and the General Contractor and the Supply Contractor pursuant to the terms of the Contract and include:

.1 Modifications of drawings issued by Addenda;

.2 Drawings submitted by the General Contractor or Supply Contractor during the progress of the work and accepted by the District either as attachments to change orders or as non- modifying supplements to the drawings in the Tender Documents including drawings issued by Addenda;

.3 Drawings submitted by the District to the General Contractor or Supply Contractor during the progress of the work either as attachments to change orders or as explanatory supplements to the drawings in the Tender Documents including drawings issued by Addenda;

"Engineer" means the Engineer of the District and any person duly authorized to act as Engineer on behalf of the District;

"General Contractor" means the person, who or which is to install the Goods supplied pursuant to the Contract;

"Goods" means the goods set out in Section 00 10 00 Clause 1.2.1 and comprising the subject matter of this Contract;

"Notice of Award" has the meaning set out in Section 00 10 00 Clause 11.4;

"Specifications" means that part of the Contract Documents consisting of general requirements and written descriptions of the technical features of materials, equipment, construction systems, standards and workmanship;

"Submittals" means the information which has to be submitted to the District in accordance with Section 01 33 00;

"Supply Contractor" means the person who or which executes the Agreement;

"Tenderer" means a person submits a Tender;

"Tender" means a Tenderer's offer set out in Section 00 20 00 and includes the Tender Documents;

"Tender Closing" has the meaning set out in Section 00 10 00 Clause 1.3.1;

"Tender Documents" means the documents, drawings and addenda set out in Section 00 20 00 Clause 2.1;

"District" has the meaning set out in Section 00 10 00 Clause 1.1

"WHMIS" means Workplace Hazardous Materials Information System.

"Work" means anything and everything required to be done for the fulfilment and completion of this agreement.

1.2 PARTNERSHIPS & JOINT VENTURES

.1 If the Supply Contractor is a partnership or joint venture the individual partners or joint venturers shall be jointly and severally liable for all of the Supply Contractor's representations, warranties, covenants and obligations under the Contract.

1.3 CONTRACT REQUIREMENTS

.1 Successors' Obligations

.1 The Contract shall enure to the benefit of and be binding upon not only the parties hereto but also their respective successors and permitted assigns.

.2 Assignment of Contract

.1 The Supply Contractor shall not assign the Contract in whole or in part, nor any payments due or to become due under the Contract without the prior written consent of the District. No assignment of the Contract shall relieve the Supply Contractor from any obligation under the Contract or impose any liability on the District. Involuntary assignment of the Contract as a result of, inter alia, bankruptcy, assignment of the Contract for the benefit of creditors or appointment of a receiver, or insolvency shall be deemed default under the Contract entitling the District to terminate the Contract as hereinafter provided.

.3 Waiver of Rights

.1 Except as herein provided, no act or failure to act by the Supply Contractor, the District, or the Engineer at any time with respect to the exercise of any right or remedies conferred upon them under this Contract shall be deemed to be a waiver on the part of the Supply Contractor, the District or the Engineer, as the case may be, of any of their rights or remedies. No waiver shall be effective except in writing. No waiver of one right or remedy shall act as a waiver of any other right or remedy or as a subsequent waiver of the same right or remedy.

.4 Amendment of Contract Documents

.1 The Contract Documents shall not be amended except as specifically agreed in writing signed by both the District and the Supply Contractor.

1.4 LAWS, REGULATIONS AND PERMITS

.1 The Contract shall be construed under and according to the laws of the Province of

.1 British Columbia and subject to an agreement to refer a dispute to arbitration under Section 00 50 00, Clause 2.4.7, the parties agree to irrevocably attorn to the jurisdiction of the Courts of the Province of British Columbia.

.2 The Supply Contractor shall give all notices required by law and shall comply with all laws, acts, ordinances, rules and regulations relating to or affecting the Goods. If any permits, authorizations, approvals or licences from any government or governmental agencies are necessary or desirable for the prosecution of the Work they shall be obtained by the Supply Contractor at its expense, provided that the Supply Contractor shall not make application for any such permit, authorization, approval or licence without first obtaining the written consent of the District.

.3 Patents, Royalties and Copyright

.1 The Supply Contractor shall pay all fees, royalties or claims for any patented invention, article, process or method that may be used upon or in a manner connected with the Goods or with the use of the Goods by the District. Before final payment is made on the account of this Contract, the Supply Contractor shall, if

requested by the District, furnish acceptable proof of a proper release from all such fees or claims.

.2 If the Supply Contractor, its agent, employee or any of them is prevented from furnishing or using any invention, article, material or Drawings supplied or required to be supplied or used under this Contract, the Supply Contractor either shall promptly pay such royalties and secure the requisite licences or, subject to written approval by the District, substitute other articles, materials or appliances in lieu thereof which are of equal efficiency, quality, finish, suitability and market value to those planned or required under the Contract.

.3 The Supply Contractor shall submit to the Engineer descriptive information of these proposed substitutions. Approval by the District of any substitutions shall not relieve the Supply Contractor of its responsibility if the substitutions do not function as well as the original specified in the Contract and shall not be deemed an assumption of risk or responsibility by the District. Approval shall only mean the District has no objection to the substitution being utilized at the Supply Contractor's risk. If the District refuses to approve the substitution, the Supply Contractor shall pay such royalties and secure such valid licences as may be requisite for the District, its directors, officers, agents and employees or any of them, to use such invention, article, material or appliance without being disturbed or in any way interfered with by any proceeding in law or equity on account thereof.

.4 All references to money in the Contract Documents shall be interpreted as meaning lawful currency of Canada.

1.5 HEADINGS

.1 Headings to parts, divisions, sections, clauses and forms are inserted for convenience of reference only and shall not affect the interpretation of the Contract Documents.

Part 2 District-Supply Contractor Relations

2.1 AUTHORITY OF DISTRICT

.1 Acceptability of Goods

.1 The District shall make the final determination of the acceptability of the Goods.

.2 Authority of Engineer

.1 The Engineer shall represent the District at the Delivery Point. The Engineer shall have the authority set out in the Contract Documents and such other authority as may be delegated in writing by the District including but not limited to the following:

.1 to make decisions regarding the Goods;

.2 to make decisions regarding the manner of performance and rate of progress of supply of the Goods;

.3 to make decisions regarding clarifications and interpretation of the Contract Documents.

The District may appoint a new Engineer from time to time by providing notice of such appointment to the Supply Contractor

2.2 RESPONSIBILITIES OF THE SUPPLY CONTRACTOR

.1 Attention to the Goods

.1 The Supply Contractor shall diligently attend to the supply of the Goods so that they are delivered faithfully, expeditiously and in accordance with the Contract Documents.

.2 Authorized Representative

.1 The Supply Contractor shall advise the Engineer in writing of the name of the Supply Contractor's authorized representative.

.3 Off-loading of Goods

.1 The Supply Contractor shall provide all necessary instruction and Delivery Point personnel to ensure satisfactory off-loading, storage, and testing of the Goods.

.4 Shipment

.1 The Supply Contractor shall properly package all Goods for safe shipment to the Delivery Point and a Notice of Shipment shall be sent by the Supply Contractor to the District at least 2 weeks before the Goods are shipped. The Notice of Shipment shall state the number of the order, the kind of goods, the Supply Contractor's name and the carrier and route by which the shipment is being made.

.2 The Notice of Shipment shall indicate appropriate instructions, considerations or other information regarding the proper storage, handling, transfer, off-loading and installation of the Goods.

.5 Acceptable Delivery

.1 The Supply Contractor will arrange to have the Goods delivered to the Delivery Point between 8:00 a.m. and 3:30 p.m. Monday to Friday, statutory holidays excepted. The District shall not be responsible for Goods delivered outside the acceptable time for delivery.

.6 Transportation Costs

.1 If the Contract calls for payment of any transportation cost by the District, the District shall in no event be liable or accountable in excess of the actual costs of transportation.

.2 Supply Contractor shall be accountable for and pay any excess transportation costs arising from Supply Contractor's failure to make delivery to the Delivery Point or to follow shipping instructions furnished by the District.

.7 Employee Safety

.1 The Supply Contractor alone shall at all times be responsible for the safety of its employees, its subcontractors' employees and other persons and equipment lawfully at the Delivery Point in connection with the supply of Goods and shall comply with the standards for the Work Site, the Workers' Compensation Act and regulations thereto and under statutory and common law.

.2 The Supply Contractor shall cooperate with the directions of the General Contractor who will be designated as prime contractor for purposes of the Workers Compensation Act.

.8 Confidentiality

.1 The Supply Contractor shall agree not to divulge or release any information that has been given to it or acquired by it on a confidential basis during the course of providing the Goods.

2.3 DISTRICT - SUPPLY CONTRACTOR CO-ORDINATION

.1 Notice

.1 Any notice, order, directive, request or other communication (the "notice") given by the District or the Engineer to the Supply Contractor shall be deemed to be given to the Supply Contractor if left at any office used by the Supply Contractor or delivered to any of its officers or employees or posted at the Delivery Point or mailed by mail addressed to the Supply Contractor at the address given in the Contract Documents or mailed to the Supply Contractor's last known place of business. Any notice given to a Supply Contractor that is a joint venture or partnership shall be deemed to be given if delivered or mailed to any one of the joint ventures or partners or any of their officers or employees. Any notice to be given by the Supply Contractor to the District shall be deemed to have been given if sent by mail or delivered to the District at the address of the District set out in Section 00 10 00 Clause 1.3.1. Any notice sent by mail shall be deemed to have been given five (5) Days after the day of mailing.

.2 Co-operation and Entry on Delivery Point

.1 At the time of Delivery, it is intended that the Delivery Point will be under the control of the General Contractor responsible for the delivery of the construction contract, as the Prime Contractor as debard by WorkSafe BC Regulations. The Supply Contractor is to coordinate all actions while on the site with the General Contractor.

.3 The Engineer, if requested by the District or the Supply Contractor or any other contractor, shall consider any differences, conflicts or disputes between the Supply Contractor and any other contractor with regard to the Goods on or near the Delivery Point. The Engineer shall give such directions as it considers desirable to resolve such difference, conflict or dispute and its directions shall be binding on the Supply Contractor and insofar as it may have the authority, on any other contractor.

2.4 DISPUTE RESOLUTION

.1 Disputes

.1 A dispute occurs between the District and the Supply Contractor where there is a difference between the parties as to the interpretation, application or administration of the Contract.

.2 Determination by Engineer

.1 Except as otherwise specifically provided, questions regarding interpretation, application or administration of the Contract shall be referred by the Supply Contractor in writing to the Engineer for its decision. The Engineer shall review the matter and respond to the Supply Contractor in writing with the Engineer's decision within 21 Days after receipt of written notice from the Supply Contractor.

.3 Dispute of Decision

.1 If the Supply Contractor disputes a decision or instruction of the District or the Engineer (the "Disputed Decision"), the Supply Contractor shall give a detailed written notice of the dispute to the District within 21 Days of the date that the Supply Contractor received the Disputed Decision. The written notice must set out the nature of the dispute, the circumstances which gave rise to the dispute, the date on which these circumstances arose and the estimated cost of the work.

.2 The Supply Contractor shall be conclusively deemed to have accepted a decision or instruction of the District or the Engineer if the Supply Contractor does not dispute the Disputed Decision by giving the required written notice within the required time .

.4 No Engineer's Review

.1 Notwithstanding Section 00 50 00, Clause 2.4.3, if the Disputed Decision was made by the District pursuant to Section 00 50 00, Part 7, the Engineer shall not review the decision and the matter shall be dealt with as provided under Section 00 50 00, Clause 2.4.7.

.5 Instructions Pending Resolution

.1 If the Disputed Decision is not resolved promptly, the Engineer shall give any instructions as may be necessary for the supply of the Goods and to prevent delay in delivery of the Goods pending resolution of the dispute. The Supply Contractor shall comply immediately with the Engineer's instructions. If it is subsequently determined that the instructions were contrary to the Contract Documents, the District shall pay the costs incurred by the Supply Contractor in carrying out those instructions beyond what the Contract Documents required.

.6 Notice of Claim

.1 No payment shall be made by the District to the Supply Contractor in addition to the Contract Price on account of any extra expense, loss or damage incurred by or sustained by the Supply Contractor for any reason unless the Supply Contractor has given written notice of a claim to the District within 30 Days of the date the Supply Contractor first became aware of the circumstances which gave rise to the claim. The written notice must set out the date on which these circumstances arose and the estimated amount of the claim.

.2 The Supply Contractor shall be conclusively deemed to have waived any right to make a claim for any amount in addition to the Contract Price, if the Supply Contractor does not give the required written notice within the required time and provide the required information.

.7 Dispute/Claim Resolution

.1 All claims, disputes or Disputed Decisions between the District and the Supply Contractor that are not resolved shall be decided by arbitration if the parties agree, or failing agreement, in a Court of competent jurisdiction within the Province of British Columbia.

.2 In the event that the parties agree to arbitration, pursuant to Section 00 50 00, Clause 2.4.7.1, the arbitration shall be governed by the rules of the British Columbia International Commercial Arbitration Centre, except that the arbitrator or arbitrators shall be agreed upon by the parties, and failing agreement by the parties, shall be appointed by a Court of competent jurisdiction within the Province of British Columbia.

.3 In the event that the parties agree to arbitration, the arbitration shall take place in Victoria, British Columbia and be governed by the laws of British Columbia.

Part 3 Specifications and Drawings

3.1 INTERPRETATION OF SPECIFICATIONS AND DRAWINGS

.1 General

.1 The Specifications and Drawings are intended to be explanatory of each other. Goods specified on the Drawings and not in the Specifications, or vice versa, shall be executed as if specified in both.

.2 Request for Clarification

.1 If the Supply Contractor requires any clarification concerning the Specifications or Drawings, it shall direct its request in writing for clarification to the District. The District may issue a letter of clarification to the Supply Contractor if the District considers it necessary to do so.

3.2 CONFLICTING PROVISIONS, ERRORS AND OMISSIONS IN CONTRACT DOCUMENTS

.1 Conflicting Provisions

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

.1 the Agreement: Section 00 40 00
.2 the letters of clarification, if any
.3 the most recent Addendum
.4 other Addenda, the more recent taking precedence over earlier
.5 Addenda
.6 the General Conditions
.7 the Notice of Award and/or Purchase Order
.8 the Tender
.9 the Specifications
.10 the Drawings
.11 the Invitation to Tender
.12 other Contract Documents.

.2 Errors and Omissions

.1 If the Supply Contractor discovers that there are any errors or omissions in the Contract Documents, it shall immediately notify the District in writing. The District will review the matter and if it concludes that there is an error or omission, it shall determine the corrective actions to be taken and will advise the Supply Contractor accordingly. If the corrective work associated with an error or omission increases or decreases the amount of work called for in the Contract, the District shall issue an appropriate change order. After discovery by the Supply Contractor

of an error or omission in the Contract Documents any work thereafter performed by the Supply Contractor shall be done at its risk unless otherwise agreed by the District.

.3 Figured dimensions on a drawing take precedence over measurements scaled from the drawing, and large-scale drawings take precedence over those of a smaller scale. Supplementary drawings and specifications supersede their antecedents. In case of conflict between figured dimensions on a drawing and the dimensions of a specified product, the dimensions of the specified product will govern.

Part 4 Material, Equipment and Workmanship

4.1 GENERAL

.1 The Goods shall be new and of the quality specified. All work related to the Contract Documents shall be done with new materials, articles, equipment and workmanship of the best quality and description and by employment of properly skilled workers and in strict conformity with and as required by the Contract Documents. Materials and equipment shall be the product of suppliers or manufacturers of established good reputation, regularly engaged in the supply or manufacture of such materials or equipment.

4.2 DEMONSTRATION OF COMPLIANCE WITH CONTRACT REQUIREMENTS

.1 Inspection

.1 The District or the Engineer or any inspector or agent appointed by either of them shall have access to the Goods and to the places the Goods are being manufactured, assembled, fabricated, stored or transported or where materials, equipment and machinery are being obtained for the Goods. The Supply Contractor at the Supply Contractor's sole cost shall provide to the Engineer or the District the assistance necessary for obtaining such access and shall provide all information necessary or desirable in connection with the inspection of the Goods.

.2 The Supply Contractor shall at all times give and cause to be given to the District or the Engineer or any inspector or agent appointed by either of them, free access to inspect and test the Goods, wherever same is being performed or carried out.

.3 Such inspections and testing shall not in any way relieve the Supply Contractor from any of its obligations or responsibilities under the Contract Documents, and shall not in any way prejudice or constitute a waiver of any rights or remedies of the District or any guarantees, warranties or covenants in favour of the District, and the District shall be entitled to rely on the expertise and obligations of the Supply Contractor and its subcontractors and their consultants and engineers to the same extent as if such inspections and testing by the District or the Engineer or any inspector or agent had not taken place.

.4 If the Contract Documents, laws, ordinances, or any public regulatory authority require parts of the Goods to be specially inspected, tested or approved, the Supply Contractor agrees that the Goods shall comply.

.5 The Goods are subject to inspection and acceptance by the Engineer within a reasonable time after receipt. The Engineer will notify the Supply Contractor in writing of the rejection of any of the Goods which are not in accordance with the Contract Documents, and the Goods will be held subject to disposition by the

Supply Contractor at the Supply Contractor's risk and subject to all charges accruing as a result of such rejection.

.6 Notwithstanding any prior payment therefore, all Goods are subject to inspection and testing by the District at the Delivery Point and if the Goods are to be incorporated into an operating facility, the District's inspection and testing of the Goods may be made under operating conditions after the Goods have been installed.

.2 Certification

.1 Where compliance of Goods, materials or equipment with the Contract Documents is not readily determinable through inspection and tests, the Engineer may require that the Supply Contractor provide, at the Supply Contractor's expense, properly authenticated documents, certificates or other satisfactory proof of compliance. These documents, certificates or other proof shall include performance characteristics, materials of construction and the physical or chemical characteristics of materials.

.3 Expenses

.1 Unless otherwise specified in the Contract Documents, the Engineer's travel, subsistence and labour expenses for inspection and testing shall be paid by the District. If the Supply Contractor requests the Engineer to inspect and test the Goods, materials or equipment at the point of manufacture, then the additional costs to the District for travel, subsistence and labour expenses shall be paid by the Supply Contractor and may be deducted by the District from any payment due to the Supply Contractor under the Contract. After an inspection by the Engineer, if the Goods, materials or equipment require further inspection by the Engineer, then the additional costs to the District for travel, subsistence, and labour expenses shall be paid by the Supply Contractor and may be deducted from any payment due to the Supply Contractor under the Contract.

4.3 DEFECTIVE OR IMPROPER GOODS

.1 Correction of Defective Goods

.1 If upon inspection, testing or otherwise the Goods or any portion thereof are found to be non-conforming, unsatisfactory, defective, or of inferior quality or workmanship, or fail to meet any guarantee of operating or other specifications contained herein, or any other requirements of the Contract Documents, then without prejudice to any other rights or remedies, the Engineer may give notice of its dissatisfaction to the Supply Contractor either verbally or in writing and the Supply Contractor shall immediately upon receipt of such notice do all things that are required to satisfy the Engineer. Any such verbal notice may be confirmed in writing by the Engineer if requested by the Supply Contractor within one working day of the verbal notice. If the Supply Contractor refuses or neglects to do all things that are required to satisfy the Engineer within one week from the receipt of notice, the District may employ some other person to do so and all expenses and costs consequent thereon or incidental thereto shall be charged to the Supply Contractor. The employment of such other person or the doing of the said work by the District itself shall not affect the Supply Contractor's duties and liabilities hereunder or relieve the Supply Contractor from the performance and fulfilment of any or all of

the Supply Contractor's warranties, covenants, undertakings, obligations and duties under the Contract.

.2 If upon inspection, testing or otherwise the Goods or any portion thereof are found to be non-conforming, unsatisfactory, defective, or of inferior quality or workmanship, or fail to meet any guarantee of operating or other specifications contained herein, or any other requirements of the Contract Documents, then without prejudice to any other rights or remedies, the District may return the Goods or any part thereof to the Supply Contractor at the Supply Contractor's sole cost and all amounts theretofore paid by the District to the Supply Contractor on account of the Contract Price of such returned Goods, shall be repaid to the District by the Supply Contractor. The Supply Contractor shall advise the District in writing, where to return the Goods, and failing such advice from the Supply Contractor, the Supply Contractor agrees to accept the returned Goods at the Supply Contractor's registered office. Neither the inspection nor failure to make inspection, nor acceptance of Goods shall release the Supply Contractor from any warranties or other provisions of this Contract nor impair the District's right to reject non-conforming Goods. The District reserves the right even after it has paid for and accepted Goods to make a claim against the Supply Contractor on account of any Goods which do not prove to be satisfactory or are defective irrespective of the District's failure to notify the Supply Contractor of a rejection of non- conforming Goods or revocation of acceptance thereof, or to specify with particularity any defect in non-conforming Goods after rejection or acceptance thereof.

.3 Retention of Defective Goods

.1 If in the opinion of the Engineer any portion of the Goods supplied under the Contract is defective or not in accordance with the Contract Documents and if the defect or imperfection in the same is not of sufficient magnitude or importance to make the Goods dangerous or undesirable, or if the removal of such Goods is impracticable, or will create conditions which are dangerous or undesirable, the District shall have the right and authority to retain such Goods instead of requiring the defective or imperfect Goods to be removed and reconstructed, but the District shall be entitled to make such deductions from the payments due or to become due to the Supply Contractor as are just and reasonable.

.4 No Implied Approval

.1 The fact that the Engineer or the District has not disapproved of or rejected any part of the Goods shall not be deemed or be construed to be an acceptance of any such part of the Goods or any such materials.

4.4 WARRANTY AND GUARANTEE

.1 The Supply Contractor agrees that the Goods Manufacturer's standard warranty will be to the benefit of the District and warrants that the Goods are free from all defects arising from faulty construction, manufacturing, materials, equipment or workmanship for the period of the Goods manufacturer's standard warranty period.

.2 The Supply Contractor warrants and guarantees that the Goods are free from all defects arising from faulty construction, manufacturing, assembly, materials, equipment or workmanship in any part of the Goods for a period of 12 months commencing from Dewatering equipment start-up and commissioning sign-off by the District. During the warranty period, the Supply Contractor, upon the receipt of notice in writing from the District or the Engineer, shall promptly make all repairs arising out of the defects referred

to in this Clause 4.4.2. The District shall be entitled to make such repairs, if 10 Days after the giving of such notice to the Supply Contractor, the Supply Contractor has failed to make or undertake with due diligence the repairs. In case of an emergency, where, in the opinion of the District or the Engineer, delay could cause serious loss or damage, or inconvenience to the public, repairs may be made without notice being sent to the Supply Contractor, only after all reasonable attempts have been made to contact the Supply Contractor. The costs of any repair made by the District in connection with this Clause 4.4.2 shall be charged to the Supply Contractor and the Supply Contractor shall reimburse the District for such costs. All covenants and agreements shall continue to be binding on the Supply Contractor until they have been fulfilled.

.3 The District is relying on Supply Contractor's skill and judgment in selecting and providing the proper Goods and any applicable services for the District's particular use. The Supply Contractor warrants to the District and its successors in interest that the Goods and any services covered hereby will correspond with the description of the same in the Contract Documents, will conform to all applicable Specifications, will be new and of the best quality and, unless otherwise specified, will be fit for the purpose for which they are to be used and will conform in all aspects, both in the manufacture and use thereof, with all applicable safety orders or regulations of the Province of British Columbia. The Supply Contractor also warrants that the Goods are free and clear of all liens and encumbrances whatsoever and that the Supply Contractor has a good and marketable title to the same.

.4 The Supply Contractor warrants and guarantees that the Goods are free from all defects arising at any time from faulty design in any part of the Goods.

Part 5 Indemnification and Insurance

5.1 INDEMNIFICATION AND RELEASE

.1 The Supply Contractor shall save harmless and indemnify the District and its council members, officers, servants, employees and agents (the “Indemnified Parties”) from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature (including but not limiting the generality of the foregoing, in respect of death, injury, loss or damage to any person or property) arising in any way out of or connected with the Goods or the supply, or delivery of the Goods or performance of the Work under this Agreement, except to the extent that such actions, claims, demands, proceedings, suits, losses, damages, costs and expenses were caused by the Indemnified Parties or any of them.

.2 Unless otherwise specified in the Contract, the Supply Contractor shall save harmless and indemnify the Indemnified Parties from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature arising in any way from liability of any nature or kind for or on account of any copyrighted or uncopyrighted composition, secret or other process, patented or unpatented invention, articles or appliances manufactured, supplied or used in the Goods, and/or used or to be used by the District before or after supply of the Goods as a result of work performed by the Supply Contractor, and if the Supply Contractor shall fail to save harmless and indemnify in manner aforesaid, any money collected from the Indemnified Parties shall be charged to the Supply Contractor.

.3 The indemnity provided in this Clause 5.1 by the Supply Contractor to the Indemnified Parties shall not in any way be limited or restricted by any insurance or by limitations on

the amount or type of damages, compensation or benefits payable under the Workers' Compensation Act or any other similar statute.

5.2 INSURANCE

.1 General

.1 The Supply Contractor shall itself obtain and maintain, at its own expense, the insurance set out below until all conditions of the Contract have been fully complied with.

.2 Commercial General Liability Insurance

.1 Commercial General Liability Insurance providing third party bodily injury and property damage coverage in an amount of not less than $5,000,000 per occurrence, indicating that the District are additional insured and containing a cross liability and/or severability of interest clause protecting each insured to the same extent as if they were separately insured.

.2 The Policy shall contain a clause providing that the District will receive 30 Days notice of cancellation or of any material change in coverage which will reduce the extent of coverage provided to the District. The certificate will also indicate that the policy contains non-owned automobile liability and contractual liability coverage. The insurance policy will be in a form and with a company which are, in all respects, acceptable to the District.

.3 Evidence of Coverage

.1 The Contractor shall file with the District prior to the commencement of work a certificate of insurance covering all policies and endorsements. The Supply Contractor shall also file with the District evidence of the renewal of each policy at least fifteen (15) Days prior to the expiry date of the policy.

.4 Indemnity Not Restricted by Insurance

.1 The provisions for insurance shown above shall not in any way limit the indemnity granted by the Supply Contractor to the Indemnified Parties elsewhere in this section.

5.3 PATENT, TRADEMARK OR COPYRIGHT

.1 The Supply Contractor represents that it has fully investigated all Specifications, including any furnished by the District, in connection with the Goods and based on such investigation and its past experience and superior knowledge with respect to such Goods has determined that the production and supply thereof will not infringe any patent, trademark or copyright.

.2 The Supply Contractor warrants to the District and its successors in interest that the manufacture, sale or use of the Goods and any services covered by this Contract, whether manufactured in accordance with the Specifications or otherwise, do not and will not infringe upon any patent, trademark or copyright. The supply Contractor shall save harmless and indemnify the Indemnified Parties from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature arising in any way from liability of any nature or kind for or on account of any copyrighted or uncopyrighted composition, secret or other process, patented or unpatented invention, articles or appliances manufactured or used in connection with the Goods, and

used or to be used by the District unless otherwise stipulated in this Contract, and if the Supply Contractor shall fail to save harmless and indemnify in manner aforesaid, any money collected from the Indemnified Parties shall be charged to the Supply Contractor.

Part 6 **Shipment of Goods/Damage to Goods**

6.1 **SHIPMENT OF GOODS**

.1 Delivery of Goods

.1 The Supply Contractor must deliver the Goods to the Delivery Point. Delivery of the Goods to a carrier for transmission to the Delivery Site does not constitute delivery of the Goods to the District. Any such carrier is deemed to be the Supply Contractor's agent and not the District's agent.

.2 Delivery Costs

.1 The Supply Contractor is responsible for all costs and expenses whatsoever in relation to the supply and delivery of the Goods to the Delivery Point, including without limitations, all shipping, carrier, transportation, freight, insurance, storage, handling costs, as well as any customs or excise charges or duties.

.3 Supply Contractor to Bear Risk

.1 The Supply Contractor shall bear all risks and shall assume all responsibility for the Goods, including, without limitation, any loss or damage to the Goods from any cause whatsoever, up to and including the delivery of the Goods at the Delivery Point.

.4 Loss or Damage

.1 If loss or damage to the Goods occurs for which the Supply Contractor is responsible, the Supply Contractor shall immediately effect repairs or replace any property as necessary in order to make good any such loss or damage. If the Supply Contractor refuses or neglects to do so, the District may make good any such loss or damage, either by itself or by employing some other person, and the expense of doing so shall be charged to the Supply Contractor. If any repair or replacement of property is performed on the Goods as a result of loss or damage to the Goods for which the Supply Contractor is responsible the Supply Contractor agrees that the warranty provided in Section 00500 Clause 4.4 shall not be affected or changed to any manner or respect whatsoever.

.5 Acceptance of Delivery of Goods by District

.1 Notwithstanding any other provision in the Contract Documents, the District is not deemed to have accepted the Goods until the Goods have been delivered to the Delivery Point and the District has had a reasonable opportunity of examining them for the purpose of ascertaining whether they are in conformity with the Contract and has confirmed such acceptance in writing. The District's acceptance of the Goods shall not prejudice any rights or remedies the District may have hereunder relating to Goods that are found to be non- conforming, unsatisfactory, defective, of inferior quality or workmanship, or which fail to meet any specifications or requirements of the Contract Documents.

Part 7 Progress and Completion

7.1 CONTRACT TIME

.1 Prosecution of the Goods

.1 Time shall be strictly of the essence. The Supply Contractor shall supply the Goods in accordance with the Contract Documents. The Supply Contractor acknowledges that the schedule for supply of the Goods as set out in the Contract Documents is reasonable.

.2 Schedule

.1 The Supply Contractor shall provide a schedule and reports for scheduling and co-ordinating the supply of Goods within the prescribed time. Contract time extensions, if any, shall be incorporated into updated schedules. The failure of the Supply Contractor to comply with this requirement shall entitle the District to terminate the Supply Contractor's right to continue with the supply of Goods or to delay progress payments.

7.2 TERMINATION

.1 The District may terminate the Contract if the Supply Contractor at any time becomes bankrupt, makes an assignment of his property for the benefit of his creditors, or if a receiver or liquidator should be appointed. Such termination shall be effective upon the District giving notice thereof.

.2 If at any time the District forms the opinion that the Supply Contractor is in default under this Contract because the Supply Contractor:

.1 has breached any provision of the Contract ;

.2 has failed to supply the Goods, within the time specified in the Contract Documents;

.3 has failed or is failing to furnish or to maintain a detailed schedule;

.4 has become in any way unable to supply the Goods or any part thereof;

.5 has repeatedly failed to make prompt payments to subcontractors, suppliers or others for labour, materials or equipment;

then the District may give notice in writing to the Supply Contractor of such opinion and require that such default or defaults be remedied forthwith. If, within five Days of such notice, such default or defaults are not remedied to the satisfaction of the District, the District may terminate the Contract. Such termination shall be effective immediately.

.3 Upon termination pursuant to Section 00 50 00 Clause 7.2.1 or 7.2.2 the District may take all Goods out of the Supply Contractor's hands and employ such means as the District may see fit. In such case:

.1 The Supply Contractor shall have no claim for any further payment in respect of the Goods;

.2 No objection or claim shall be raised or made by the Supply Contractor by reason of or on account of the ultimate cost of the Goods so taken over for any reason proving greater than, in the opinion of the Supply Contractor, it should have been;

.3 Notwithstanding Part 8 all materials and all rights, proprietary or otherwise, licences, powers and privileges, whether relating to or affecting real or personal

property, acquired, possessed, or provided by the Supply Contractor for the purposes of supply of the Goods will become or remain and be the property of the District for all purposes incidental to the completion of supply of the Goods and may be used, exercised, and enjoyed by the District as fully to all intents and purposes connected with supply of the Goods as they might theretofore have been used, exercised, and enjoyed by the Supply Contractor;

.4 The District may assign all rights and privileges granted to the District in this clause to another supply contractor retained by the District to continue with the supply of the Goods.

.5 If the Supply Contractor's right to supply the Goods is terminated in accordance with the provisions of this clause, the Supply Contractor shall not be entitled to receive any further payment until the supply of Goods is completed.

.4 Except as herein before provided, the Supply Contractor shall have no claim against the District for any reason whatsoever by reason of the termination of the Contract.

Part 8 **Payment**

8.1 **PAYMENTS TO SUPPLY CONTRACTOR**

.1 Payments to the Supply Contractor will be made on the basis of the Schedule of Quantities and Prices, Schedule 1 of Section 00 20 00 Tender Form. Refer to Section 01 27 00 – Measurement and Payment as to description of how payments will be made.

.2 Notwithstanding Clause 8.1.1 the District may withhold from any payment:

.1 Any deduction the District may be entitled to under the Contract;

.2 Such amount as the District determines appropriate with respect to secure the correction or completion of any obligation under the Contract not properly or satisfactorily completed in compliance with the Contract Documents; and

.3 Amounts required to be held back pursuant to the Builders Lien Act (British Columbia).

.3 Payments may be withheld until the relevant operating manuals and all operating and maintenance materials together with all warranties have been delivered to the Engineer.

.4 In addition to any other remedy the District may have in the Contract or law, the District may refuse to make payment because of subsequently discovered evidence or test results, and shall be compensated for any payment previously made to the Supply Contractor to such extent as may be necessary to protect the District from loss as a result of:

.1 Defective or damaged Goods;

.2 A deductive change order;

.3 Failure of the Supply Contractor to supply the Goods in accordance with the Contract Documents, including failure to maintain the supply of the Goods in accordance with the schedule;

.4 Disregard by the Supply Contractor of the authority of the Engineer or the laws of any public body having jurisdiction.

The District may refuse to make payment of the full amount because of claims made against the District on account of the Supply Contractor's performance or supply of Goods. In such case, the District shall give the Supply Contractor prompt written notice stating the reasons for each action.

.5 The District, may withhold from payment to the Supply Contractor:

.1 Any set-off the District may be entitled to under the Contract;

.2 The amount of any bona fide builder's lien claim asserted against the District or which the District acting reasonably anticipates will be made against the District.

.6 Prior to payment to the Supply Contractor, if requested by the District, the Supply Contractor shall deliver to the District a statutory declaration in form satisfactory to the District declaring that all subcontractors, labour and accounts for material and equipment have been paid and that no persons have any lien against the lands comprising the Delivery Point or the work together with such other documentation as the District, acting reasonably, determines is necessary or desirable.

.7 Builders Liens

.1 The Supply Contractor shall, at its own cost and expense, cause any and all builders liens and other liens for labour, services or materials alleged to have been furnished in connection with the supply of the Goods to the lands comprising the Delivery Point which may be registered against or otherwise affect the said lands or the supply of Goods, to be promptly discharged from title to such lands.

8.2 **WHMIS**

.1 The Supply Contractor must comply with all requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of material safety data sheets in accordance to all applicable laws.

.2 The Supply Contractor must deliver copies of all relevant material safety data sheets to the Engineer upon delivery of goods.

END OF SECTION

APPENDIX A

DRAFT NOVATION AGREEMENT

BETWEEN:

(DISTRICT)

AND:

(CONTRACTOR)

AND:

(SUPPLY CONTRACTOR)

WHEREAS:

A. District entered into a Contract with the Supply Contractor dated [_____], for the Supply and Delivery of Dewatering Equipment (Supply Contract), which is annexed hereto as Appendix "A";

B. It is a requirement of the Supply Contract that the Supply Contractor enter into a Novation Agreement with the General Contractor (hereby referred to as “the contractor”) selected by the District for the Construction Contract;

C. District entered into a contract with Contractor dated [_____], for [_____] (Construction Contract);

D. It is a requirement of the Construction Contract that the Contractor enter into a Novation Agreement with Supply Contractor so that Supply Contractor becomes a subcontractor to the Contractor;

NOW THEREFORE in consideration of the premises and of the mutual agreements hereinafter contained the parties agree as follows;

1. The Contractor and Supply Contractor agree to be bound by the terms of the Supply Contract, annexed hereto as Appendix "A", with the Contractor assuming all the rights and obligations of the District as set out therein.

2. Supply Contractor retains all the rights and obligations set out in the Supply Contract and henceforth accepts the Contractor in place of the District.

3. Supply Contractor agrees that henceforth it is a subcontractor to the Contractor in respect of the Construction Contract.

4. Supply Contractor hereby releases the District from all of the District's obligations under the Supply Contract and from all claims of every nature whatsoever arising therefrom, excepting only those claims, if any, already notified to the District in writing, and acknowledges that it will henceforth look only to the Contractor for the discharge of the District's obligations thereunder and that only the Contractor may exercise the rights of the District thereunder.

5. Henceforth, the terms and conditions of the Construction Contract insofar as they can apply to a subcontract shall govern the relations between the Contractor and the Supply Contractor; provided nevertheless, that if any term of the Construction Contract is inconsistent with any payment provision or Special Condition or Special Provision in the Supply Contract such payment provision, Special Condition or Special Provision of the Supply Contract shall prevail.

6. The District and Supply Contractor agree that the Supply Contract between them has been terminated.

7. It is agreed that as of the date hereof [$_____] is owing to the Supply Contractor under the Supply Contract.

IN WITNESS WHEREOF the parties hereto have executed this Agreement as follows:

DISTRICT OF SOOKE

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

[SUPPLY CONTRACTORS NAME]

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

Part 1 **General**

1.1 **SCOPE**

.1 Work specified in this section includes the design, supply, fabrication, assembly, performance testing at the manufacturer's facility, delivery to the Delivery Point of the Goods, testing, commissioning and operations training of Dewatering Equipment, including dewatering centrifuge, centrifuge feed pumps, polymer dosing system and full dewatering system PLC, as described elsewhere in the Specifications.

.2 The Work to be done under this contract consists of the design, fabrication, assembly, supply, delivery, assistance with installation, testing, commissioning and operations training of dewatering equipment as herein specified.

.3 The Goods will be installed under a separate contract. The Supply Contractor shall furnish all labour, materials, accessories and necessary parts to supply, fabricate, and deliver the Goods.

1.2 **REFERENCES**

.1 Section 01 33 00 – Submittals.

1.3 **SUBMITTALS**

.1 Submittals – Shops Drawings Prior to Fabrication

.2 Any manufacturing done before the review of the shop drawings by the District will be at the Supply Contractor's risk. The District shall have the right to require the Supply Contractor to make any changes in the Supply Contractor's drawings, which may be necessary, in the opinion of the District, to make the finished product conform to the requirement and intent of the Specifications, without additional cost to the District.

1.4 **DATES OF DELIVERY**

.1 The date(s) for delivery of the Goods to the Delivery Point as required by the District, or at such other date(s) of delivery as may have been proposed by the Supply Contractor in this Tender and agreed to by the District, as indicated in Section 00 20 00 – Schedule 2, defined the latest time the District can begin its process of installing and commissioning of the Goods.

.2 Should the Supply Contractor fail to meet the accepted Contract delivery date(s), he will be held liable for all costs incurred by the District that are attributable to the late delivery of the Goods.

1.5 **PLACE OF DELIVERY**

.1 Delivery Point: (See Section 00 50 00, Part 6) Sooke Waste Treatment Facility, V9Z 0S2,

, BC. as defined in Section 00 10 00 Clause 1.2.3.

.2 Specific on-site delivery location to be confirmed by and coordinated with the District and General Contractor (once selected) prior to shipment to the Delivery Point. Delivery of the Goods shall take place during regular working hours (Monday through Friday, 07:00 to 15:30 hours).

.3 Two (2) weeks' notice shall be given to the General Contractor prior to intended delivery so that arrangements can be made for unloading and storing the Goods.

.4 The General Contractor will arrange to provide reasonable access to the site. The Supply Contractor is responsible for arranging off-loading of the Goods at the Delivery Point and shall allow

.5 One and a half (1.5) hours free waiting time for each load arriving at the site. This free hour and a half (1.5) will commence at the time of arrival at the site requested by the District, or at the actual time of arrival, whichever is later. Waiting time in excess of one and a half (1.5) hours will be paid for by the District at the normal rate of hire for the truck less 25 percent, provided that a claim shall be made within two (2) working days.

1.6 RATES OF DELIVERY

.1 The District may change the schedule or sequence of the fabrication and delivery of the Goods to best suit the District's installation and commissioning program. The Supply Contractor shall adjust its manufacturing and delivery schedule for the Goods to the Delivery Point in response to reasonable requests from the District, such that the amount of re-handling of the Goods is minimized.

.2 If required by the District to suit the construction schedule, delivery of the Goods shall be made in multiple deliveries over time, as necessary, during this time frame to minimize the time that Goods are stored on-site prior to installation.

1.7 HANDLING

.1 The Supply Contractor shall assume full responsibility for protection and safekeeping of all Goods supplied under this Contract until such time as they are delivered to the Delivery Point, at which time the District will assume full responsibility for protection and safekeeping of the Goods after they have been off-loaded from the delivery vehicle(s). The Supply Contractor shall be responsible for the Goods while in transit to the Delivery Point and off-loading the Goods at the Delivery Point.

.2 Any damage which may be done in handling, shipping, or off-loading at the Delivery Point shall be made good by the Supply Contractor at its expense and any cost that the District shall be put to by reason of such damage will be charged to the Supply Contractor.

.3 The District will inspect the Goods upon delivery to the Delivery Point, and the Supply Contractor will be notified promptly of any damage prior to off-loading. The District will be responsible for handling and storage of the Goods at the Delivery Point, and any re-handling prior to installation.

.4 Any Goods, which do not pass the appropriate standards or are subsequently found to be defective, will be returned to the Supply Contractor at the Supply Contractor's own expense.

1.8 QUALITY ASSURANCE TESTS

.1 Additional quality assurance testing will be at the discretion of the District upon initial inspection of the Dewatering Equipment at the Delivery Point. Refer to Section 01 43 00 – Quality Assurance.

.2 Quality assurance tests will include any tests that the District may deem necessary to ensure the Goods will perform as required, and those required by the Specifications.

.1 The District may employ an independent testing firm to conduct quality control tests to determine compliance of the Work with the Contract Documents. Should material or workmanship be found to be unacceptable, the full cost of further testing relating to the deficiency shall be charged to the Supply Contractor.

.2 The Supply Contractor shall have no claim for delays, interruptions, double handling of materials, rejection of materials, or any other cause brought about by such tests, including awaiting the outcome of such tests.

.3 The Supply Contractor shall provide adequate notice to the Engineer to permit testing to be conducted at appropriate times in an efficient manner.

.4 Unless otherwise specified, the costs of testing will be assumed by others. In the event of a failed test the cost of retesting shall be borne by the Supply Contractor.

.5 The Supply Contractor shall provide material samples to the Engineer in such quantities as required for testing for conformance with the specification. The Supply Contractor shall make good to at least the original standard any area from which material samples are taken.

END OF SECTION

Part 1 **General**

1.1 **SCOPE**

.1 This section refers to the measurement and payment of the work unique to the supply and delivery of the Goods described herein. This section must be referenced to and interpreted in conjunction with all other sections in the Contract Documents.

.2 Descriptions contained in the payment clauses provide a general description of the tasks.

.3 They are not meant to limit the Work.

.4 The items mentioned in this section refer to the items so numbered in Section 00 20 00 Schedule 1 – Quantities and Prices.

1.2 **SUBMITTALS**

.1 Monthly Invoice(s)

.1 The Supply Contractor shall submit an invoice at the end of each calendar month for all of the Goods delivered and accepted during that month.

.2 The invoice shall clearly indicate applicable taxes; the purchase order number; the amount of the invoice including any holdbacks and the amount billed to date.

1.3 **DESCRIPTION OF PAYMENT ITEMS**

.1 The prices proposed in Section 00 20 00 Schedule 1 shall include the cost of all applicable submittals, labour, material, equipment; and other expenses necessary for supplying the Dewatering equipment, manufacturer performance tests and for performing all other work necessary and incidental to the supply and delivery of the items specified in this Tender as required to achieve the design alignment as indicated on the drawings and specifications. The prices shall include all taxes other than GST, freights, duties, brokerage fees, and similar charges.

.2 The Supply Contractor will be paid at the prices submitted in Section 00 20 00 Schedule 1 – Quantities and Prices– Tender Form for such amounts or quantities of each classification of product as are delivered and reviewed by the Engineer from time to time.

.3 The Supply Contractor shall make no claim for anticipated profits, loss of profit, damages, or any extra payments whatsoever, except as expressly provided otherwise herein, because of any difference between the amounts of material actually furnished and the estimated amounts as herein set forth.

1.4 **PROGRESS PAYMENTS**

.1 Progress payments will be made on the following basis:

.1 For delivery of the shop drawings, of each item in Section 00 20 00 Schedule 1, Quantities & Prices, the Supply Contractor will be paid ten percent (10%) of the accepted price for the item(s) received, less any amount the District is entitled to withhold pursuant to the Contract Documents.

.2 For each item in Section 00 20 00 Schedule 1 – Quantities & Prices, thirty (30) days after delivery of the Goods to the Delivery Point and receipt of an invoice, whichever is later, the Supply Contractor will be paid eighty percent (80%) of the accepted price for the item(s) received, less any amount the District is entitled to withhold pursuant to the Contract Documents.

.3 Thirty (30) days after the commissioning, satisfactory to the District, of the Goods following completion of the Construction Contract or upon receiving all outstanding submittals, deliverables, compliance report, and invoice, whichever is later, the Supply Contractor will be paid the remaining ten percent (10%) of the accepted price, less any amount the District is entitled to withhold pursuant to the Contract Documents. The Construction Contract is intended to be commissioned by the end of March 2020.

1.5 CHANGE ORDERS, SUPPLY CONTRACTOR'S RESPONSIBILITIES

.1 The Supply Contractor shall complete and promptly return all Change Order price requests issued by the District. Include appropriate supporting documentation to verify prices.

.2 The Supply Contractor shall not proceed with work affected by a change order price request until authorized to do so by Change Order.

.3 The Supply Contractor shall make no change in the supply of Goods unless a Change Order is issued.

.4 Change Orders are only valid when signed by the District.

END OF SECTION

Part 1 **General**

1.1 **DESCRIPTION**

.1 This section describes the Supply Contractor's responsibilities for making submittals to the Engineer to demonstrate that materials, equipment, methods, and work comply with the provisions and intent of the Contract Documents.

.2 The Supply Contractor shall provide submittals in accordance with this section and as specified in Section 01 10 00, Clause 1.3.

.3 Submittals covered by this specification include manufacturers' information and technical data sheets, descriptive data, certificates, product data, shop drawings, test procedures, test results, samples, all mechanical, electrical and electronic equipment and systems, fabricated items and miscellaneous work-related submittals.

.4 The Engineer may require additional submittals from the Supply Contractor when, in the opinion of the Engineer, such additional submittals are warranted.

.5 The Supply Contractor shall notify the Engineer, in writing, when re-submitting any revisions other than those requested by the Engineer.

.6 Where submittals are required in any Section, they shall be submitted by the due date specified in Schedule 2 Section 00 20 00.

.7 Execution shall not commence until the Supply Contractor has received the District's comments on its submittals and has been advised to commence the work. The District's or Engineer's review of the submittals does not relieve the Supply Contractor of his duties and responsibilities as specified under Section 00 50 00 – General Conditions of this Contract.

1.2 **SUBMITTAL REQUIREMENTS**

.1 Each submission shall be coordinated with the requirements of the Work and the Contract Documents. Individual submissions will not be reviewed until all related information is available.

.2 Make submittals far enough in advance to allow adequate time for coordination, review, revisions and re-submittals, and for the supply and delivery of the Goods.

1.3 **SCHEDULE**

.1 The Supply Contractor shall submit a proposed schedule for review within two (2) weeks from Notice of Award. The schedule shall include all submittal dates, manufacturing, testing, and delivery of the Goods.

1.4 **SUBMITTAL CATEGORIES**

.1 Submittals fall into two (2) general categories:

.1 Submittals for review.

.2 Submittals for information only.

1.5 **SHOP DRAWINGS**

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Supply Contractor to illustrate details of a portion of the Work.

.2 Detail all shop drawings using the metric system. Prepare to a drafting standard equivalent to the Contract drawings.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, wiring diagrams, panel layouts with bills of material, explanatory notes and other information necessary for completion of Work. Where articles and equipment attach or connect to other articles or equipment, indicate that such item have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross reference to design drawings and specifications.

.4 Adjustments made on shop drawings by the Engineer are not intended to change the Contract Amount. If adjustments affect the value of Work, state such in writing to the Engineer prior to proceeding with the Work.

.5 Make such changes in shop drawings as the Engineer may require, consistent with Contract Documents. When resubmitting, notify the Engineer in writing of any revisions other than those requested.

.6 Submit four (4) "white print" copies of product data sheets or brochures for requirements requested in specification Sections and as the Engineer may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.7 The Supply Contractor shall submit a minimum of four (4) hard copies and one (1) electronic copy of each drawing to the Engineer for his review. The Engineer will retain two (2) copies of each drawing.

.8 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings shall be submitted together, to enable the Engineer to review the drawings as a package.

.9 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular material.

.10 Manufacturers' catalogues, manuals, or price list will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

.11 Indicate the tag number of instructions and values and clearly show the features and details applicable to the equipment being supplied.

.12 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring the seal of a Professional Engineer registered in the Province or Territory where the work is located, in accordance with the applicable provincial or federal engineering acts or other governing legislation. Seal such drawings

before submitting them for review. Submit for review engineering calculations signed by the registered Professional Engineer responsible for the shop drawing design elements.

.13 If, upon review by the Engineer, no errors or omissions are discovered or if only minor corrections are made, one (1) stamped electronic copy will be returned and fabricated and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings must be performed before fabrication and installation of Work may proceed.

.14 Use only those shop drawings on the work that bear the Engineer's "REVIEWED" notation.

.15 District may deduct, from payments due to Supply Contractor, cost of additional Engineering work incurred if correct shop drawings are not submitted after one review by Engineer.

.16 Review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that the Engineer approves the detail design inherent in the shop drawings, responsibility for which remains with the Supply Contractor, and such review does not relieve the Supply Contractor of his responsibility for errors and omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Supply Contractor is responsible for dimensions to be confirmed and correlated at the job-site, for information that pertains solely to the fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

.17 The specifications identify those items for which shop drawings shall be submitted.

1.6 PRODUCT DATA

.1 Product data shall include manufacturer's catalogue sheets, brochures, literature, performance charts and manufactured products. Refer to Specifications for Specific Requirements.

.2 Submit four (4) hardcopies and one (1) electronic copy of all product data.

Part 2 Products

2.1 TRANSMITTAL FORM

.1 Accompany all submittals with a standardized transmittal form for each specific item, class of material, equipment and items specified in separate, discrete sections in duplicate containing:

.1 Date;
.2 Contract number;
.3 Project title and number;
.4 Equipment number;
.5 Supply Contractor's name and address;
.6 Identification and quantity of each shop drawing;

.7 Name and address of:

.1 Subcontractor;

.2 Supplier;

.3 Manufacturer;

.4 Other pertinent data.

.2 Identify the Section in the Specifications or the Drawing number to which the Submittal refers to.

.3 Assign a unique number, sequentially assigned, on the transmittal form accompanying each item submitted. Submittals will be classified according to categories agreed to by the Supply Contractor and District. Use the following format by category for submittal numbers: "XXX", where "XXX" is the sequential number assigned by the Supply Contractor. Resubmittals will have the following format: "XXX-Y", where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for re-submittals, i.e., A, B, or C being the 1st, 2nd, and 3rd re-submittals, respectively. Submittal 025-B, for example, is the second re- submittal of submittal 25.

Part 3 **Execution**

3.1 **ADMINISTRATIVE**

.1 Provide to the Engineer for review the submittals specified. Submit all information promptly and in an orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.

.2 Submit four (4) copies of submittals, unless noted otherwise in these specifications.

.3 Do not proceed with work affected by any Submittal until review is complete. Normally, submittals for review and comment will be returned to the Supply Contractor within seven (7) days of receipt, exclusive of any time awaiting clarification or further information; however, the time for returns may vary and may exceed seven (7) days depending upon the complexity of the Submittal, the number of submittals, and the express needs of the Supply Contractor.

.4 Review all submittals prior to submission to the Engineer including those from subcontractors and suppliers. The Supply Contractor’s review represents to the District that the necessary requirements have been determined and verified, or will be, and that each Submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified by the Supply Contractor will be returned without being examined and will be considered rejected.

.5 The Supply Contractor is responsible for the accuracy and completeness of information submitted. The Supply Contractor shall notify Engineer in writing of materials, equipment or methods of work that deviates from the Contract Documents. Notification in writing, to accompany Submittal transmittal and noted under deviations.

.6 The Supply Contractor's responsibility for errors, omissions and deviations in submission is not relieved by the Engineer's review of Submittals.

.7 Keep one (1) reviewed copy of each submission at the Work Site.

.8 All shop drawings shall be prepared in metric units.

.9 The Supply Contractor shall maintain a single schedule of the status for all Submittals. This schedule shall be kept up-to-date and presented to the District for each item submitted.

.10 Submittals requiring re-submission shall be submitted with their entire respective document section or tab to assist in document tracking in regard to the most current revision number. Piecemeal submittals will not be accepted and will be returned without review.

3.2 SUBMITTALS FOR REVIEW

.1 All submittals, except where specified to be submitted for information only, are to be submitted by the Supply Contractor to the Engineer for review.

.2 Review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept in accordance with the Specifications. This review does not mean that the Engineer approves the detail design inherent in the Submittals, Shop Drawings and data sheets, responsibility for which remains with the Supply Contractor, and such review does not relieve the Supply Contractor of its responsibility for errors or omissions in the Shop Drawings and data sheets or of its responsibility for meeting all requirements of the Contract Documents.

.3 Indicate all materials, methods of construction, methods of attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for the supply of the Goods and the installation thereof. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co- ordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross references to Drawings and Specifications.

.4 Submittals for review will be returned to the Supply Contractor with one of the four following notations:

.1 If the review indicates that the material or equipment complies with the contract documents, submittal copies will be marked "Reviewed". In this event, the Supply Contractor may begin to implement the work method or incorporate the material or equipment covered by the Submittal.

.2 If the review indicates limited modifications are required, copies will be marked "Reviewed as Modified". The Supply Contractor may begin implementing the work method or incorporating the material and equipment covered by the Submittal in accordance with the noted corrections. Where Submittal information will be incorporated in operation and maintenance data, the Supply Contractor shall provide a corrected copy.

.3 If the review reveals that the Submittal is insufficient or contains incorrect data, copies will be marked "Revise and Resubmit". Do not undertake work covered by this Submittal until it has been revised, resubmitted and returned marked either "Reviewed" or "Reviewed as Modified".

.4 If the review indicates that the material, equipment, or work method does not comply with the Contract Documents, copies of the Submittal will be marked "Rejected". Submittals with deviations, which have not been previously identified

clearly may be rejected. Do not undertake the work covered by such submittals until a new Submittal is made and returned marked either "Reviewed" or "Reviewed as Modified".

.5 After submittals are stamped "Reviewed" or "Reviewed as Modified", no further revisions are permitted unless re-submitted to the Engineer for further review.

.6 If upon review by the Engineer, no errors or omissions are discovered or if only

.7 minor corrections are made, one (1) stamped copy noting “Reviewed or Reviewed as Modified” will be returned and fabrication and supply of the Goods may proceed. If shop drawings and data sheets are rejected, the one (1) stamp copy noting “Revise and Resubmit or Not Reviewed” will be returned, and resubmission of corrected shop drawings and data sheets, through the same procedure indicated above, is to be performed before fabrication of the Goods may proceed.

.8 The District may deduct, from payments due to Supply Contractor, costs of additional Engineering reviews incurred if shop drawings and data sheets are not corrected after one review by the Engineer.

3.3 SUBMITTALS FOR INFORMATION ONLY

.1 Submittals for information only will be used by the Engineer for general information and filed without comment. The Engineer retains the right to return submittals for information only if the Submittal does not comply with the Contract Documents and general design criteria.

.2 Submittals for information only are not subject to review procedures. They are to be provided as part of the Work under the Contract and their acceptability determined under normal inspection procedures.

.3 Where specified, the Supply Contractor is to submit engineering calculations sealed by a qualified Professional Engineer for information only.

3.4 ELECTRONIC DRAWING FORMATOF FINAL/CERTIFIED SHOP DRAWINGS

.1 Electronic drawing files are to be AutoCAD 2014 format to District of Sooke standards. An electronic template drawing in paper space with the District’s standard border and drafting standards will be provided to the Supply Contractor upon request after award.

.2 Submit electronic drawing files on CD-ROM or USB memory stick.

END OF SECTION

Part 1 **General**

1.1 **SCOPE**

.1 This section contains the general requirements of the District's quality assurance program as well as procedures used by the District to check the Supply Contractor's Quality Control Program.

1.2 **QUALITY ASSURANCE**

.1 The District may itself carry out inspections, measurements, and testing of the Work in order to assure that the quality of the Work is in accordance with the requirements of the Contract Documents, and to check and verify the quality control results and records of the Supply Contractor's Quality Control Program.

.2 All or any part of the Work, and any off-site locations where material or products for the Work are being prepared or stored, may be inspected by the Engineer when and as often as deemed expedient in order to meet the objectives of quality assurance.

1.3 **ACCESS FOR INSPECTION AND TESTING**

.1 The District shall be granted access to the Work at all reasonable times. If parts of the Work are in preparation at locations other than the Work Site, the Supply Contractor shall, at the request of the Engineer, arrange for safe access to such locations for the purposes of granting the Engineer the opportunity to undertake quality assurance inspections and/or tests.

.2 The District shall give the Supply Contractor timely notice of the Engineer's intention to carry out any specific inspections and tests on any aspects of the Work. The Engineer may, however, carry out routine inspections and tests on any part of the Work without notice.

.3 Once notice has been given by the District, the Supply Contractor shall not by any means prevent access to, or deny access to, Work that has been selected for specific tests, inspections or approvals. If the Work has continued without testing, inspection or approvals, the Supply Contractor shall undo such Work to the point where testing, inspection or approvals were to be performed at no additional cost to the District.

.4 The District may wish to inspect or test sections of the Work which have already been completed prior to any previous inspections. The costs of testing such Work will be borne by the District, unless the section of Work is found to be in non-conformance with specified quality requirements, in which case the costs shall be borne by the Supply Contractor.

1.4 **INDEPENDENT TESTING AGENCIES**

.1 The District may appoint an independent testing agency to undertake quality assurance inspections or tests on any parts of the Work. The Supply Contractor shall grant to any such agency the same access privileges as are required to be given to the District. The costs of hiring an independent testing agency will be borne by the District.

.2 The employment of independent testing agencies by the District shall in no way absolve the Supply Contractor of its responsibility to perform the Work in accordance with the quality requirements of the Contract Documents, and to conduct all necessary quality control inspections and testing.

1.5 **NON-CONFORMANCE**

.1 Work that does not meet the quality requirements of the Contract Documents will be rejected.

.2 Unacceptable quality may result from poor workmanship, improper construction procedures, non- compliance with manufacturer's instructions, improper and careless handling, and the use of defective or damaged products and/or materials.

.3 The Supply Contractor shall rectify all sections of the Work that are found, as a result of quality assurance inspections and tests, to be in non-conformance with the quality requirements of the Contract Documents. Where it is not possible or practical to repair a non-conforming or defective material, product, or component of the Work, to the satisfaction of the District, that material, product or component shall be removed from the Work and a new replacement be provided.

.4 Where a section of the Work, or a product, is found to be in non-conformance, the Supply Contractor shall be responsible for all the costs of rectifying, replacing, re- inspecting and re-testing the Work to bring it to conformance. The District shall have the right to deduct the costs of all re-inspection and re- testing carried out by the District from progress payments due to the Supply Contractor.

.5 Where a section of the Work, or a product, is found to be in non-conformance by quality assurance testing, the Supply Contractor shall increase the frequency of quality control testing on adjacent areas or similar products.

.6 The Supply Contractor may challenge the results of any quality assurance tests indicating non- conformance. The section of Work in question shall be re-tested by an independent testing agency acceptable to both the Supply Contractor and District. Should the retest confirm the results of the earlier test, the Supply Contractor shall bear the costs of the additional tests. Should the re-test indicate conformance with the required quality standards, the District shall cover the costs of the tests.

Part 2 **Products**

Not applicable to this Section.

Part 3 **Execution**

3.1 **SPECIFIC QUALITY ASSURANCE TESTS**

.1 Refer to the Specifications for Specific Quality Assurance Tests to be carried out by the Supply Contractor.

.2 The Specifications may call for specific quality assurance tests to be performed on the Work by the District. The Supply Contractor shall give the District, or its appointed

independent testing agency, appropriate notice as to when the Work will be ready for such tests. The District will not be responsible for delays occasioned by the Supply Contractor's omission in giving the required notice.

.3 The Supply Contractor shall submit samples of materials, products or equipment required for testing where specifically called for in the Specifications. These items shall be submitted promptly and in an orderly sequence so as not to cause delay to the Work.

.4 The Supply Contractor shall provide sufficient labour and facilities to obtain and handle samples of materials, products and equipment required for test. The Supply Contractor shall also provide sufficient space to store, and where necessary cure, test samples and products.

3.2 REPORTS

.1 At the request of the Supply Contractor, the District shall submit to the Supply Contractor copies of results of any quality assurance tests undertaken by the District or by its appointed independent testing agency.

.2 The Supply Contractor shall provide copies of inspection and test results to its subcontractors and suppliers where quality assurance tests were performed on materials, products, or work supplied or undertaken by them.

.3 The Supply Contractor shall provide copies of the reports required for the specific Quality Assurance tests listed in the Specifications.

END OF SECTION

Part 4 **General**

4.1 **SCOPE**

.1 This section outlines the responsibilities of the Supply Contractor with respect to controlling the quality of the Work required to be completed under the terms of the Contract. The required quality standards for the various aspects of the Work are contained in the specific sections of these Contract Documents.

4.2 **SUBMITTALS**

.1 Within seven (7) days of the date of issue of the Notice of Proceed, the Supply Contractor shall submit a Quality Control Program to the District for review. The District will, within seven (7) days of receipt of the program, respond in writing to the proposed program. The Supply Contractor shall submit copies of test results to the District within twenty-four (24) hours of them becoming available. If the tests are completed on the Work Site, the Supply Contractor shall provide the District with a field memo summarizing the results immediately following testing.

4.3 **REQUIREMENTS**

.1 The Supply Contractor shall conduct, at its own cost, all necessary quality control testing that is required to demonstrate the Goods conforms to the Contract Documents.

.2 The Supply Contractor shall be responsible for all aspects of the quality of the Work and shall put into place a suitable Quality Control Program to ensure that quality standards are met, and that the Work meets the requirements and intent of the Contract Documents.

.3 The Supply Contractor shall appoint an independent testing agency to undertake quality control tests that are required by the Contract Documents, and for which the Supply Contractor does not have suitable resources and equipment.

.4 The independent testing agency used by the Supply Contractor shall be manned by qualified personnel and have facilities that are certified to CSA, ASTM and other specified test methods for the sampling and testing of materials. The independent testing agency requires the acceptance of the District.

.5 The District may carry out quality assurance testing and inspection in order to assure that Work is generally in accordance with the Contract Documents and to verify the Supply Contractor's quality control data.

.6 Testing and inspection by the District will not relieve the Supply Contractor of its responsibility to perform quality control testing and inspection.

4.4 **PAYMENTS AND DELAYS**

.1 No separate or additional payment will be made to the Supply Contractor for quality control. The costs thereof will be considered to be included in the proposal prices for the various items of work to be performed under the Contract. Likewise, no extension of time

shall be allowed for any delay occasioned by the need to carry out inspection and testing, or to rectify work in non-conformance with quality standards.

Part 5 **Products**

Not applicable to this Section.

Part 6 **Execution**

6.1 **QUALITY CONTROL PROGRAM**

.1 The Supply Contractor shall develop a Quality Control Program, which shall be submitted to the District for review.

.2 The program shall include, but not be limited to, the following:

.1 The names and designations of persons employed by the Supply Contractor who will be responsible for quality control and what each person's function will be.

.2 The name of an independent inspection and testing agency that will be used to monitor the quality of the Work.

.3 The procedures that will be adopted by the Supply Contractor to ensure conformance with the requirements of the Specifications and Drawings.

.4 The procedures for the control of items purchased by the Supply Contractor to ensure that they are of specified quality and size, and procedures for the proper care and storage of such items on site before inclusion in the Work.

.5 The procedures for the control of documents and drawings to make sure that only the latest revisions are used, and that the contents of change orders, instructions, minutes, etc., issued by the District, are followed.

.6 Inspection and testing methods, including testing of materials, welds, valve leakage, etc., and a description of what methods will be used if not specifically listed in the Contract Documents. The proposed locations and frequencies of testing shall also be indicated.

.7 A description of how non-conformance with quality standards or project specifications will be tracked and what remediation methods will be followed to achieve conformance.

.8 The procedures for the control, distribution, and safekeeping of all quality testing and inspection records.

.3 All Work shall be performed in strict adherence to the accepted Quality Control Program.

6.2 **QUALITY CONTROL TESTING**

.1 The Supply Contractor shall conduct, at its own cost, all necessary quality control tests that are required to demonstrate that the materials, products, and completed Work conform to the Contract Documents.

.2 The Quality Control Measures listed in the Specifications are a minimum only. The Supply Contractors Quality Control Program and testing shall include such tests required to prove the functionality and safety of the equipment.

.3 Minimum quality standards and testing requirements shall be in accordance with the Contract Documents, and if not stated therein, with all applicable laws, regulations, standards and codes.

.4 The locations and frequencies of tests required under this section shall be determined by the Supply Contractor and/or the independent testing and inspection agency working on behalf of the Supply Contractor and shall be selected to test all aspects of the Work.

.5 The Supply Contractor shall report, track, correct and retest any deficient Work determined by the quality control or quality assurance programs at no additional cost to the District.

.6 The Supply Contractor's quality control testing and the District's quality assurance testing will form the basis for acceptance of the Work.

.7 All test reports shall contain at least the following information:

.1 Project identification;
.2 The nature of the test;
.3 Dates of sampling, testing and reporting;
.4 The names of the personnel involved;
.5 The location of the test (with sketch if required);
.6 The specified quality standard required;
.7 The test results achieved; and
.8 Remarks regarding conformance or non-conformance with the specified requirements.

END OF SECTION

Part 1 General

1.1 INTRODUCTION

.1 This specification outlines the minimum requirements for the design, fabrication, supply, testing and commissioning of Electrical equipment provided as part of a mechanical or process packaged system to be supplied by a Supplier for the Sooke Dewatering Project at Sooke, British Columbia.

.2 The equipment defined within this specification includes but is not limited to the starters, motors, enclosures, cable, conduit and tagging standards as required for the packaged system.

.3 The services defined within this specification includes but is not limited to the supply, factory acceptable testing, delivery to site, installation support, testing (lead), commissioning (lead), training (lead) and collection of all support documentation.

.4 This specification is complementary to Equipment Data Sheets, drawings and specifications that may form part of the tender documents.

.5 It shall apply to those items installed on equipment and those items supplied loose by the Supplier.

.6 Refer to Division 17 for specification of common I&C elements.

1.2 DEFINITIONS

.1 **Contractor**: Site Installation Contractors

.2 **Supplier:** Equipment or Process System material provider

.3 **The Owner**: District of Sooke; the end user

.4 **Engineer**: Equipment Specifier

.5 "When specified", "Where specified" or "As specified" shall mean information shown on the accompanying Data Sheets or drawings by the Engineer.

1.3 LANGUAGE AND UNITS

.1 All documentation shall be provided in English.

.2 All units of measurement shall be in Imperial units.

.3 Where a component or piece of equipment is manufactured using the International Systems of Units (SI units), the SI units should be shown as the primary dimensions, with the Imperial equivalent shown in brackets.

1.4 CODES AND STANDARDS

.1 The design and installation of all instruments shall comply with the rules and provisions of the latest editions and amendments of the Standards and Codes of Practice listed below.

Document No.	Standard Title
ASME PTC 19.3,	Temperature Measurement
ASME B 40.100,	Pressure Gauges and Gauge Attachments
ASME B 40.200,	Thermometers, Direct Reading and Remote Reading
ASME Section VIII,	Pressure Vessels, Division I
ASTM E230	Standard Specification and Temperature-Electromotive Force (EMF) Tables of Standardized Thermocouples
ISA-S5.1	Instrument Symbols and Identification
ISA-75.01-1985	(R1995) - Flow Equations for Sizing Control Valves
ISA /ANSI-MC 96.1	Temperature Measurement Thermocouples
ISA 20	Instrument Specification Forms
ISA 75.02,	Control Valve Capacity Test Procedures
ISA 75.04,	Face-to-Face Dimensions for Flangeless Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.08,	Installed Face-to-Face Dimensions for Flanged Clamp or Pinch Valves
ISA 75.08.03	Face-to-Face Dimensions for Socket Weld-End and Screwed-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)
ISA 75.08.04	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (Class 4500)
ISA 75.08.07	Face-to-Face Dimensions for Separable Flanged Globe-Style Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.15	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (ANSI Classes 150, 300, 600, 900, 1500 and 2500)
ISA 75.16	Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (ANSI Classes 900, 1500, and 2500)
ISA 75.22	Face-to-Centreline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (ANSI Classes 150, 300, and 600)
UL 508A	Standard for Industrial Control Panels
NEMA 250	Enclosures for Electrical Equipment
CEC	Canadian Electrical Code (latest edition)
CSA	Canadian Standards Association ***(all electrical equipment shall bear the CSA label)***
API – RP551	American Petroleum Institute, Process Measurement Instrumentation
ANSI/ISA-7.0	Quality Standard for Instrument Air
ANSI B16.36	Steel Orifice Flanges

.2 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.3 Quality control is in accordance with the applicable International Standards Organization (ISO) standard.

.4 In addition to Codes and Standards listed above, the following requirements shall apply:

.1 All equipment and assemblies shall carry the CSA, cUL or equivalent mark approved for use by the local Safety Authority with an associated declaration of conformity.

.2 In the event that specific equipment does not bear an acceptable equipment certification, the Supplier shall obtain local review, inspection, approval and labelling by a certification agency such as CSA, cUL or equivalent that is acceptable to the authority having jurisdiction.

.3 The Supplier shall pay for all costs for local inspection and any equipment modification as directed by the certification agency to obtain approval.

.4 In case of a conflict between Standards, CSA Standards take precedence in the interpretation of the requirements over other Standards.

.5 The design and construction shall also comply with the requirements of all authorities having jurisdiction over the site for the type of equipment specified herein.

1.5 CONFLICTS BETWEEN DOCUMENTS

.1 Conflicts between referenced documents shall be identified to the Engineer in writing for resolution. In general, the order of precedence is:

.1 Diagrams and Schedules

.2 Specifications (equipment) and Data Sheet

.3 Purchase Order

.4 This specification

.5 Referenced applicable standards

.2 In the event of any conflict between the Purchase Order, Specifications, Codes and Standards or lack of clear definition as to the applicability of any specification or standard, Supplier shall obtain a written clarification from the Owner before proceeding. The Owner's response and / or instructions shall subsequently form part of this Specification.

1.6 SUPPLIER INFORMATION

.1 The Owner's approval of Supplier's drawings and documentation does not in any way relieve the Supplier of his responsibility to meet the above criteria.

.2 The Supplier shall submit sufficient information (pressures, temperatures, flow rates, specific gravities, corrosive conditions, controller set points, alarm set points, ranges, etc.) to permit The Owner to execute the necessary review and checking activities and to develop control narratives, interconnecting diagrams, and shutdown and security circuits.

.3 Supplier shall provide, and The Owner shall review, interface drawings for complete compatibility with Supplier's equipment, interfacing with The Owner's electrical System and for safe functioning of the equipment.

1.7 DOCUMENTATION

.1 Provide drawings / data as referenced in the subsections below.

1.8 LOCATION DRAWINGS

.1 All field instruments and associated connections to equipment or process shall be shown in their proper locations on the following types of drawings:

.1 Piping Plans and Elevations; and

.2 Location Drawings.

1.9 DESIGN CONSIDERATIONS

.1 Supplier shall be fully responsible for furnishing instruments and instrument systems, meeting the following minimum design considerations:

.1 Meets the design requirements of the Packaged Equipment;

.2 Optimum Operation of Process;

.3 Suitable Quality;

.4 Suitable materials and coatings for the environment and conditions;

.5 Availability of support and spare parts;

.6 Reliability and proven technology;

.7 Quality Construction; and

.8 Safe Operability.

.2 The Engineer will review all sizing (based on information provided by the Supplier) prior to the Supplier purchasing the instrument. Review by the Engineer does not waive the Supplier's responsibility for suitable and safe design.

.3 Supply panel drawings for all panels supplied as part of the package. The drawings shall show equipment layout, dimensions, wiring, a bill of materials and tubing details. See Control Panels section below.

.4 Provide standard catalogue data (including technical specifications, wiring details, and instructions for maintenance, operation, and installation) for all equipment provided. Highlight information relevant to the actual instrument being used.

1.10 EQUIPMENT NUMBER AND TAGGING

.1 Label all field equipment with a 25 x 50 mm rectangular stainless steel labels stamped with the assigned tag numbers (6 mm high lettering). The Supplier shall affix the label to the equipment with drive pins or stainless steel wire in such a manner that it need not be removed for installation of the equipment.

.2 Follow Owner standards (available upon request).

.3 Wire numbering: Consistent with nomenclature used in available sample drawings.

1.11 EQUIPMENT INSTALLED IN HAZARDOUS AREAS

.1 All equipment and electrical devices that are fully or partially located within a hazardous area shall be suitably rated for the area classification.

.2 Conduit and cabling systems to instruments located in hazardous areas shall be in accordance with the CEC.

.3 Electrical equipment intended for use within a designated hazardous area shall meet the latest requirements of the Canadian Electrical Code C22.1, and as adopted in the Province of Alberta.

.4 Provide all necessary certification for electrical equipment specifically designed for use in designated hazardous areas. A separate certificate shall be provided for all individual pieces of equipment.

.5 Ensure to reference the Area Classification drawings, where provided, to confirm the location of the equipment and the classification of the space where the equipment is installed.

.6 Equipment rating methods are discussed further in Part 2 of this document.

1.12 SUPPLIER RESPONSIBILITY

.1 The Supplier is responsible for the functionality and suitability of all equipment provided as a part of their scope supply, including equipment that is shipped loose for connection to the packaged system equipment.

1.13 SUPPLIER SCOPE

.1 Supply all electrical equipment required to operate the package systems that either mounts directly on the equipment or is field installed and wired to the systems.

.2 Prewire all field mounted equipment and devices to terminals in NEMA 4X junction boxes.

.3 Make provisions in the packaged control systems to interface to the plant electrical system as defined in the equipment specification.

.4 Provide onsite support to lead integration efforts of the equipment; this effort will coordinate with the site Contractor and the Client.

.5 Provide a testing program and site services to implement the testing of the system (dry and wet) with the Contractor and the Client.

.6 Provide a commissioning program and site services to implement the commissioning program of the system with the Contractor and the Client.

.7 Provide training material, trainer, and allow six training sessions for operations staff (4 hours per session, three in total) and maintenance staff (4 hours per session, three in total). A classroom environment will be provided for the operations staff. Hands on training to be included in part of each sessions.

1.14 MATERIALS

.1 Equipment shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.15 ELECTRICAL APPROVALS

.1 Provide instruments and control devices rated for the area classification where the devices are to be installed.

.2 CSA labelling for all equipment, both fabricated in a shop and modified in the field during construction.

1.16 SUBMITTALS

.1 Submittals shall be in accordance with Section 01 33 00 requirements.

.2 The Supplier is to provide engineering assistance to The District and its consultants for various projects as they arise, as indicated below:

.1 The Supplier will be provided with design drawings (typically single line diagrams, floor plans and proposed equipment footprints) by The District or Engineer during the detailed design stage, along with a formal request to produce shop drawings and a cost estimate (refer to Section 01 33 00 for additional information).

.2 The Supplier is to provide engineered shop drawings and associated cost estimate, based upon the terms and specifications of this RFP with any changes or modifications requested by The District or Engineer.

.3 The District and/or Engineer will review the shop drawings and cost estimate, and work with the Supplier to make adjustments to the equipment, as required, to suit the project.

.4 The Supplier shall allow for three (3) such shop drawing submissions during detailed design.

.3 Submit shop drawings, product data and samples in accordance with Section 01 33 00. The submission shall be reviewed, signed and processed as described in Section 01 33 00.

.4 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.5 Where required in specific sections, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with existing equipment and the work required in other divisions.

.6 Content

.1 Shop drawings submitted title sheet.

.2 Data shall be specific and technical.

.3 Identify each piece of equipment with appropriate tag as per equipment identification list or schedule.

.4 Information shall include all scheduled data.

.5 Advertising and commercial presentation literature will be rejected.

.6 The project and equipment designations shall be identified on each document.

.7 Information shall be given in S.I. units.

.8 The shop drawings/product data shall include as a minimum:

.1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weight's and mounting point loads.

.2 Mounting arrangements showing clearances were needed

.3 Detailed drawings of bases supports and anchor bolts.

.4 Control explanation and internal wiring diagrams.

.5 A written description of control sequences relating to the schematic diagrams.

.6 Detailed bill of materials.

.7 Submission format:

.1 Black line prints 216 mm x 280 mm [letter size] or 280 mm x 430 mm [tabloid] for control schematics.

.2 Larger drawings may be submitted on reproducible single sheet media (ie not bound) with space for stamps and signatures - master set plus one working copy.

.3 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.

.8 No. of copies:

.1 Provide number of copies indicated in Section 01 33 00 with a minimum of two (2) copies to be retained by the Engineer.

.2 Preferred mode of shop drawing distribution is in electronic format (pdf file).

1.17 CARE, OPERATION AND START-UP

.1 Provide for instructing The District's operating personnel in the operation, care and maintenance of supplied equipment as specified as follows:

.1 Provide for the services of the manufacturer’s factory service engineer to participate in and supervise the start-up of the supplied equipment installation, and to check, adjust, balance and calibrate components.

.2 Provide these services for standard period, as necessary to put equipment in operation, and including training for operating personnel for all aspects of its care and operation. Include daily rates for any additional time Supplier would be required for completion of installation and commissioning beyond standard period.

1.18 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with these specifications.

.2 Equipment and materials shall be CSA certified.

.3 Factory assemble the control compartments and component assemblies.

1.19 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into Owner's final maintenance manual specified in Section 01 78 39 and as follows.

.2 Include in operations and maintenance data:

.1 Operating instructions and start-up procedures including receiving and installation requirements.

.2 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of supplied equipment.

.3 Detailed instructions for the normal maintenance of all supplied equipment, including procedures and frequency of operational checks and service and troubleshooting instructions

.4 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature is not acceptable.

.5 Wiring and schematic diagrams: these must be specific to each individual piece of equipment, detailed with wire/cable tags and termination information, not generic.

.6 Spare parts data shall be furnished for each item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply. A list and itemized price breakdown of spare parts recommended for stocking shall be furnished. The parts selected shall be those which, in the manufacturer's judgment, will be involved in the majority of maintenance difficulties encountered.

.7 Copies of guarantees and certificates.

.8 Names and addresses of local suppliers for each item of equipment, including items in the maintenance manuals.

.3 Submit a draft copy to the Engineer for approval prior to delivery of the equipment.

1.20 PROJECT AS-BUILT DRAWINGS

.1 During the construction period, the Installation Contractor will keep on-site a clean set of final shop drawings that will be marked-up to reflect the "As-Built" state of the equipment, for examination by the Engineer on a regular basis.

.2 Upon completion of commissioning, the Installation Contractor will provide the marked-up "as-built" shop drawings to the Supplier(s), to be updated in AutoCAD format.

.3 The Supplier is responsible for providing AutoCAD format "as-built" drawings which incorporate the Contractor's field mark-ups for each individual breaker and starter bucket. Typical wiring diagrams will not be accepted. The Supplier shall submit the as-built drawings in both paper and electronic format for incorporation into site O&M manuals.

1.21 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust-resistant primer inside and outside (or phosphatizing treatment), and at least 2 mil thick electrostatic powder paint coat applied to all surfaces.

.2 Paint indoor switchgear and distribution enclosures to ASA 61, light grey.

1.22 EQUIPMENT IDENTIFICATION

.1 Provide nameplates for electrical equipment having a standard District equipment number with the following characteristics:

.1 Manufacture nameplates from 3 ply lamacoid, minimum 3.2 mm thick with 0.8 mm chamfered edges, engraved lettering and gloss finish.

.2 Use capitalized lettering centred on each row and in Gothic font, sans serif.

.3 Use self-adhesive backing filling the entire area of the back for nameplates except where insufficient area exists to reliably affix a nameplate. For nameplates without self-adhesive backing provide nameplate with 5 mm diameter tie hole.

.2 Use self-adhesive backing, type 3M™ Adhesive Transfer Tape 467MPF or Tesafix 4970 where a nameplate is affixed to a smooth surface.

.3 Use self-adhesive backing, type 3M™ Double Coated Vinyl Foam Tape 4432 at least 0.8 mm thick where a nameplate is affixed to a non-smooth or an irregular surface.

.4 Do not use embossed plastic labels.

.5 Colour coding:

.1 General Purpose - black face, white lettering (outer two plies black, inner ply white), gloss finish.

.2 Essential Electrical Circuits - white face, red lettering (outer two plies white, inner ply red).

.3 Warning Messages - red face, white lettering (outer two plies red, inner ply white).

.6 Nameplate types are designated Type 1, Type 2A / 2B, Type 3 or Type 4.

.7 Nameplate types

Nameplate Type	**Size, mm (H x W)**
Type 1	25 x 90
Type 2A	75 x 180
Type 2B	40 x 90

.8 Nameplate Type 1

.1 Use nameplate Type 1 on all MCC and Switchgear units and compartments.

.2 Conform to The District equipment numbering standard for the "Equipment Number".

.3 The inscription is to describe the equipment. Do not exceed three lines for descriptors and do not use hyphens. Place wording logically on each line.

.9 Nameplate Type 2A / 2B

.1 Use nameplate Type 2A for MCC and Switchgear identification and on stand-alone electrical cabinets.

.2 Conform to The District equipment numbering standard for the "Equipment Number".

.3 Type 2B - reduce the size of the nameplate Type 2A by 50 percent (i.e. length and width dimensions to be halved), where nameplate Type 2A is inappropriate for the equipment size.

1.23 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Identify all other wires at each end with indelible Graff-Rite heat shrink tubular markers. Acceptable manufacturer: Graff-Rite Industries Ltd., Port Coquitlam, B.C., or approved equivalent.

.1 Identification numbers shall match full wiring numbers as shown on the Drawings.

.2 Provide wire numbers for all wires and terminals where numbers are not designated on Drawings by using the format "Device tag - terminal number".

.5 Colour code wiring:

.1 600 V AC: Red for Phase A.

.2 Black for Phase B.

.3 Blue for Phase C.

.4 White for Neutral.

.5 120 V AC: Black for Hot.
White for Neutral.

.6 24 V DC: Red for Positive.
(except for loop) Black for Negative.

Loop (analog): White for Positive.

.7 Black for Negative.

1.24 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.25 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

1.26 GENERAL TESTING AND INSPECTION

.1 The equipment shall undergo factory acceptance testing in accordance with this specification.

.2 A factory acceptance Inspection and Test Plan (ITP) shall be submitted for The District review and approval. Do not proceed without an approved ITP.

.3 The equipment shall satisfactorily withstand the tests specified.

.4 The records of all tests and all relevant certificates shall be provided as required in the requisition document and these specifications.

.5 Electronic devices shall be completely tested and burned-in before being assembled into the supplied panel or gear.

.6 All factory testing shall be coordinated and scheduled in advance with The District, Engineer and Contractor. The Supplier shall give at least two months' notice prior to any test commencement.

.7 The Supplier shall ensure that all required documentation has been collated prior to the final inspection and testing.

.8 Acceptance inspection and testing shall be carried out by the Supplier on the entire assembly and witnessed by The District and the Engineer.

1.27 FIELD QUALITY CONTROL AND EQUIPMENT TESTING

.1 The Supplier shall provide a factory service representative for participation and supervision of equipment testing and quality control on site.

.2 Furnish manufacturer's certificate or letter confirming that supplied equipment has been installed to manufacturer's instructions.

.3 Include in the tendered price all costs for the attendance of the factory service representative at the site for the times and durations required to fully complete their responsibilities for participation and quality control of the site equipment testing.

1.28 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Overcurrent trip settings for main, tie, and feeder breakers located in the MCCs will be provided by the Engineer.

Part 2

2.1 MATERIALS AND WORKMANSHIP

.1 All materials and equipment to be new, of a current manufacture and free from all defects and imperfections.

.2 Electrical equipment to meet the requirements of this specification, listed codes/standards and rated for continuous operation at full load for the design conditions specified.

.3 All electrical components must be installed in grounded aluminum metal enclosures or grounded stainless steel enclosures as per the applicable CSA standard.

.4 Protective relay instrumentation and controls will be supplied and located in an isolated compartment of the equipment local control panel enclosure. This equipment shall be located on the skid or within the equipment the protective relay instrumentation is intended to protect. Terminal blocks, secondary CT connections, secondary VT connections and miscellaneous control devices shall be located in this isolated compartment. Connection terminal blocks shall be provided for all field wiring and as required for The District's external connections. Operation of the system shall not be affected by opening the compartment doors.

.5 Design and arrange system packages to account for ease of maintenance. Ensure parts and components are easily accessed and removed by maintenance personnel.

.6 Design and arrange electrical equipment to protect personnel against risk of shocks by all available means of interlock, insulation, screens, partitions, enclosures and warning labels.

.7 Provide similar items of equipment and materials from the same Manufacturer. Standardize on products to reduce the number of stocked spare parts.

.8 All equipment shall be CSA approved (or approved equivalent) and will not be shipped to site without confirmation. Any cost of electric inspection dispute related to equipment not meeting CSA approval shall be the responsibility of the Supplier.

.9 Outgoing power connection conductors will be connected to conductor lugs. These terminal blocks will be grouped horizontally near the bottom of the panel, for connection of field wiring by installing contractor. Supplier to provide aluminum, undrilled, removable gland plates for large control panels or equipment junction boxes to facilitate clear direction for installation of field wiring and protection of internals during transportation and installation.

.10 Control conductors will be connected to terminal blocks for field wiring (to external starters, instruments, etc.). These terminal blocks will be grouped together in a logic manner, for connection of field wiring by installing contractor. Supplier to provide aluminum, undrilled, removable gland plates for control panels or equipment junction boxes to facilitate clear direction for installation of field wiring and protection of internals during transportation and installation.

2.2 ELECTRICAL MOTORS

.1 Provide all motors in accordance with requirements listed in standards; CSA C22.2 No. 100, CSA C22.2 No. 145, and NEMA Standard MG1.

.2 Supplier is responsible to ensure the rating and functional characteristics of the motors match the requirements of the loads.

.3 Motors shall be designed for continuous duty operation at rated power except where the process defines different rated duty type, per the Supplier.

.4 Motors shall have a design life of at least 20 years with periodic maintenance interval of greater than five years and shall be of premium efficient, heavy duty industrial type per NEMA MG1.

.5 Provide motors capable of developing 150 percent of NEMA design B locked rotor and pull-up torques with 100 percent of rated voltage applied and capable of developing in excess of NEMA locked rotor torque values at 90 percent of rated voltage.

.6 Motors shall have sufficient capacity to operate the driven load and associated devices under all conditions of operation without overloading.

.7 Acceptable motor manufacturers are;

- .1 ABB (Baldor / Reliance)
- .2 US Motors (Emerson)
- .3 TECO Westinghouse
- .4 Siemens
- .5 Toshiba

.8 Equipment electrical motor requirements classification:

- .1 Type 1 (General Duty): Unless specified otherwise on data sheet, TEFC enclosures, to NEMA MG1.
- .2 Type 2 (Process): Unless specified otherwise on data sheet, TEFC enclosures, to NEMA MG1, suitable for moist and corrosive environment. All internal surfaces to be coated with an epoxy paint.
- .3 Type 3 (Explosion-proof type): Motors to be TEXP explosion proof rated for operation in a Class 1, Zone 1, Group IIB hazardous location in accordance with CSA C22.1-15. Provide an approved breather/drain device installed in the motor drain hole.
- .4 Type 4 (submersible applications): Motors to be waterproof with 316SS motor shaft, rated for submerged operation and hazardous area classification.

.9 Motor Insulation

- .1 Use Class F insulation
- .2 Design motor for temperature rise less than 90°C at 1.15 service factor loading.
- .3 Insulation to be non-hygroscopic.

.4 For all motor applications, dip and bake in Class H varnish a minimum of 2 times. For 284T and larger frames, dip and bake a minimum of 3 times.

.10 Current Imbalance

.1 Do not exceed the values tabulated below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system:

.1 Under 37.5 kW: 15 percent

.2 37.5 kW and above: 10 percent

.2 Base imbalance criteria upon the lowest value measured.

.11 Winding Over-temperature Protection

.1 Provide stator winding over-temperature protection on all motors rated 45 kW and larger. Motors rated less than 45 kW to have stator winding over-temperature protection when required by the specific equipment specification section or if recommended by the driven equipment Manufacturer.

.2 Over-temperature protection for motors rated 45 kW and larger and other motors, where specified, to be NEMA MG1-12.53, Type 1, winding running and locked rotor over-temperature protection. One temperature detector shall be provided per phase. Detectors to be positive thermal protection (PTC) thermistor type, with leads brought out to a terminal strip in a NEMA 4x enclosure for Type 2 motors and a NEMA 7C or 9 enclosure for Type 3 motors.

.12 Motor Frame

.1 Use a minimum of grade 25 cast iron, aluminum, or steel for frame, end brackets, fan cover, and conduit box. Refer to motor classifications.

.2 Provide two bronze automatic breather drains at the lowest point in the motor frame.

.3 On frames sizes greater than 180, provide removable lifting eyes at the balance point of the motor, with a design safety factor greater than 10. Vertical motors require two eyes, one on each side of the frame.

.4 Use stainless steel hardware.

.13 Motor enclosures shall be:

Motor Rating	**Enclosure**			
	Non-Hazardous		**Hazardous**	
	Process	**Non-Process**	**Class I, Zone 1**	**Class I, Zone 2**
0 to 0.75kW	TE	TE or ODP	TEXP	TEXP
1 to 186kW	TEFC	TEFC	TEXP	TEFC
> 186 kW	TEFC or WPII	TEFC or WPII	TEXP	TEFC

.14 Motor Terminal Box

.1 Incorporate an oversized terminal box with a volume greater than NEMA requirements, rotatable in 90° increments. Provide gaskets between the terminal box and frame and between the terminal box and cover.

.2 Provide diagonally split, gasketted NEMA 4X terminal boxes complete with threaded hub for conduit entry for ODP and TEFC motors.

.3 Provide adequately sized, diagonally split, gasketted NEMA 7 terminal boxes complete with threaded hub for conduit entry for explosion-proof motors.

.4 Provide a ground connection and lugs in the terminal box.

.5 Provide a separate terminal box for all motors required to have internal monitoring devices c/w terminal blocks.

.15 Motors for Variable Frequency Drives

.1 Select heavy duty, premium efficiency units, inverter duty rated, CSA certified to be in conformance with NEMA MG1, Part 30 and Part 31.

.2 Design to ensure turndown of 5:1 unless specified elsewhere.

.3 Use only Type 2 or Type 3 motors.

.4 Insulation: Class F insulation, suitable for 90°C temperature rise, with a 1.0 safety factor, suitable for moist and corrosive environments and in accordance with NEMA MG1 Part 30 and Part 31. Provide additional treatment at winding end turns to minimize stray current failures. Provide grounding or discharging rings for the motor bearings.

.5 Design motors for variable frequency systems so that they are not required to deliver more than 80 percent of the motor's power rating by any load imposed by the driven machine at any specified operating condition or any condition imposed by the driven machine's performance curve at maximum operating speed.

.6 Ensure motors have adequate cooling capacity when operating through the entire speed range capacity of the drive.

.16 The following voltages are used based on the motor power as follows:

Application	Motor Power Range	Utilization Voltage	Phase
DOL (direct on line)	0.56kW to 75 kW (100 HP)	575 V	3
VFD	0.56kW to 450 kW (600 HP)		
DOL	Less than 0.56 kW (3/4 HP)	120 V	1

2.3 INTERFACE TO STARTERS AND VARIABLE FREQUENCY DRIVES

.1 The Supplier will design for the use of externally mounted motor starting devices (full-voltage non-reversing, full-voltage reversing or VFD) located within a local MCC room.

.2 Supplier shall provide wire termination blocks within a panel or cabinet for connection of all field wiring to the starting devices.

.3 Where control devices are required to be mounted on or in local panels, provide panel or cabinet along with the interface terminal blocks.

.4 The individual drives (supplied by others) will be complete with breaker or fused disconnects, drive, front panel interface module and output dV/dt filter. VFDs will communicate with the Supplier control system by hard wired interface for automatic

control, and will also be wired with Profibus DP connection, providing additional diagnostic functions, such as speed / torque feedback, to the District's DeltaV system.

.5 Input power shall be based on previously defined motor voltages, based on motor sizes.

.6 The Supplier shall be responsible for coordinating the drive and motor characteristics with the installing contractor 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.

2.4 ALTERNATE SUPPLY OF VARIABLE FREQUENCY DRIVES

.1 If the Supplier decides to supply VFDs instead of wiring to VFDs supplied by the Contractor, the following clauses apply.

.2 Approved VFD make and model is ABB ACS800. No alternates.

.3 The Individual drives will be contained in a skid-mounted cabinet complete with breaker or fused disconnects, drive, front panel interface module and output dV/dt filter. VFDs will communicate with the Supplier control system by hard wired interface for automatic control, and will also be wired with Profibus DP connection, providing additional diagnostic functions, such as speed / torque feedback, to the District's DeltaV system.

.4 The Supplier shall be responsible for coordinating the drive and motor characteristics with the installing contractor 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.

.5 Filters shall be provided on the incoming line and on the load side of the VFD.

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

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

.8 The drive shall be capable of regulating the frequency to a ±1% of the set point over the full input voltage and ambient temperature operating range.

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

.10 Audible noise levels produced by the drive shall be limited to 75 dBA sound pressure at one meter, at any point throughout the operating range of the drive.

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

.12 The drive enclosure shall meet the requirements of panels and enclosures, detailed within this specification, based on the area to be installed.

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

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

.15 The drive shall have, as a minimum, circuits within the drive for connection of remote signals via Profibus DP communication and where required wired to terminal blocks for hardwire I/O as follows:

.1 Drive permissive signal (lock out switch): normally closed contact, open to emergency stop drive, operable in remote or local control mode;

.2 Remote Run signal: normally open contact, closed for run and open for stop;

.3 Remote Speed Reference signal: Isolated analog 4 mA to 20 mA input for speed set point from the packaged control system.

.16 Alarms must be latched in with first-out indication.

.17 The diagnostic system shall monitor each alarm and shutdown function and shall display the status of each point on the front panel interface module.

.18 The drive shall provide the following relay outputs (form C, rated 2 Amp at 120 VAC) as minimum:

.1 Run Status, normally open;

.2 Fault signal: normally closed contact, closed for normal and open for fault;

.19 The drive shall provide at least two isolated 4-20 mA analog outputs that are programmable to frequency, speed, current, torque, or power factory configured for:

.1 Remote Speed Indicator: Isolated analog 4 mA to 20 mA output for speed feedback to the packaged control system.

.2 Remote Current Indicator: Isolated analog 4 mA to 20 mA input for amperage feedback the packaged control system.

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

.21 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.

.22 When the equipment is exposed to corrosive gases, the equipment shall be protected against corrosion from the gases by the use of proper coatings and material selection. The use of bare copper or silver or their alloys should be avoided.

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

.24 Input Power

.1 VFDs shall have nominal voltage rating of 690 VAC; if this rating is not available, confirm acceptability of product with Engineer minimum of ten (10) days prior to bid close.

.2 Unless otherwise noted, the plant operating voltage shall be 600 VAC ±10% 3Ø, 60 Hz, power supply, with line frequency variation of up to +/-5 Hz.

.3 The VFD shall withstand switching surge of three (3) times the normal peak line to ground voltage at ½ cycle or less duration, without damage.

.4 The VFD shall tolerate power line interruptions of 50% voltage sag for up to 0.5 seconds without shutting down on a fault, providing an extended power loss ride-through. If the VFD trips on under-voltage, the VFD shall activate the Automatic Restart/Reset for under-voltage trips and utilizing the flying start function to allow the VFD to restart immediately when the power returns, if in "Remote" and the control calls for the VFD to run. The VFD shall match the motor rotating speed and take control.

.5 The VFD shall present a displacement power factor of 0.95 lagging or better to the AC line at any speed or load.

.6 Efficiency of VFD shall be not less than 96% at 60 hertz output when driving the specified maximum load. Determine the efficiency by measuring true RMS power into the VFD and measuring output on a dynamometer.

.7 The variable frequency control to operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10 percent total harmonic voltage distortion and commutation notches up to 36,500 Volt microseconds, or when other VFDs are operated from the same bus.

.8 The VFD shall not require an input isolation transformer.

.9 The VFD shall not be sensitive to supplied power that has one phase grounded (Delta) or referenced to earth ground (Wye).

.10 The VFD shall not be sensitive to incoming phase sequence.

.11 The VFD shall include transient voltage suppression to allow reliable operation encountered in an industrial power distribution system.

.25 Output Power

.1 The VFD shall produce a three-phase output for the motor load.

.2 The VFD output power stage shall convert the rectified DC into 3Ø AC power utilizing voltage source type digitally generated sine weighted pulse width modulation (PWM) switching signals.

.3 Unless otherwise specified, the standard VFD output frequency shall be adjustable from 10 to 66 Hz.

.4 Unless otherwise specified, the VFD output voltage shall be adjustable from 0 to 600 VAC, reaching 600 VAC at 60 Hz.

.5 Unless otherwise specified, the VFD shall produce a reduced volts-per-hertz (V/Hz) ratio in the below 60 Hz range.

.6 Unless otherwise specified, the VFD shall supply a constant 600 VAC output when operating above 60 Hz.

.7 The volts-per-hertz output of the VFD shall not be affected or require readjustment when other VFD adjustments (such as maximum speed) are changed.

.8 Provide selectable constant V/Hz ratio or configurable V/Hz ratio. The VFD shall have selectable pre-programmed V/Hz ratios and the capability of programming a custom V/Hz pattern. Specific V/Hz patterns shall be available for both constant torque and variable torque applications and shall be programmable.

.9 When subject to the range of ambient conditions stated herein, the VFD shall be capable of maintaining 100% of rated output current continuously.

.10 When subject to the range of ambient conditions stated herein, the VFD shall be capable of delivering 150% of rated output current for up to one minute.

.11 The VFD output waveform shall be the PWM type waveform producing smooth torque at low frequencies and low harmonics.

.12 The VFD shall have a programmable PWM carrier frequency. Minimum PWM frequency range of 2 - 15 kHz.

.13 The VFD shall be capable of operating output open circuited with no fault or damage for start-up and testing purposes.

.14 Manufacturer shall indicate on the shop drawings, the anticipated levels of audible and electrical noise, harmonics and heat generated for the range of VFDs to be supplied.

.26 The VFD shall be capable of withstanding the maximum fault level available (RMS symmetric short circuit current), as indicated on the drawings. In no case shall it be less than 50 kA.

.27 The VFD shall be equipped with voltage sag ride-through for the following:

.1 0% voltage for 1 cycle.

.2 60% voltage for 10 cycles.

.3 87% voltage continuous.

.28 The loss of AC input power longer than 15ms shall cause the drive to shut down in an orderly fashion, without causing pulsations in the drive or motor system.

.29 The drive must be programmable to attempt a flying start to recover from power brown out conditions and allow the restart of a load before it comes to a complete stop.

.30 The VFD shall have the capability of being restarted with a remote signal from either the CTG/HRSG control system or the DCS control system.

.31 The VFD shall not be affected by radio frequencies emitted by portable radio transmitters.

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

.1 The VFD shall protect itself against the following as a minimum:

.2 Under / over voltage

.3 Incoming power system phase loss

.4 Overcurrent

.5 Over temperature

.6 Output short circuit

.7 Output ground fault

.8 Output power phase loss and current imbalance

.9 DC Bus overvoltage

.10 Inverter Over-temperature

.11 Stall

.33 Loss of input power or faults (when cleared) shall be "self-reset", i.e., after the loss of AC supply power, there shall be an orderly shutdown of the system. After restoration of power, the VFD shall self-reset and start automatically if in "Remote" and the control calls for the VFD to run.

.34 VFD output faults and short circuit faults shall be manual reset at unit HMI.

.35 Integrate a motor temperature monitoring system, including power and space within the VFD cabinet and install within the front door the VFD Cabinet if a display is provided. Control unit shall interlock the drive from operating in Manual or Automatic.

.36 Built-in-network communication (Profibus DP).

.37 Diagnostics – device, warning, and trip status, time to overload trip, history of last trips, and time to reset.

.38 Control Features:

.1 Provide complete integrated control and metering as follows:

.1 Door mounted non-resettable elapsed time hour meter.

.2 Adjustable linear acceleration and deceleration from 1.0 to 25 seconds.

.3 Adjustable maximum VFD output voltage.

.4 Adjustable maximum voltage/hertz.

.5 Adjustable IR compensation.

.6 Adjustable slip compensation.

.7 Adjustable current limit from 10 to 150%.

.8 Adjustable minimum speed, 0 to 50%.

.9 Adjustable maximum speed, 50 to 110%.

.10 Remote / Local bumpless speed transfer.

.11 Input terminals for remote interlocks. Allow for minimum two interlocks or otherwise shown on the drawings.

.12 Sufficient I/O for all discrete and analog signals as indicated on the RFP drawings and wiring schematics.

.13 Minimum of four (4) discrete relay outputs.

.2 Surge Suppression: Provide isolation and voltage surge suppression for contacts used for external monitoring to limit inductive switching surges to less than 200 V

peak. Provide DC coils with free-wheeling diodes to limit inductive surges to 28 V peak.

.3 Human-Machine Interface (HMI) on VFD Front Door: Provide a digital local operator interface on the VFD door complete with the following features as a minimum:

.1 Speed raise / lower pushbuttons with digital frequency display for local speed adjustment,

.2 START / STOP pushbutton,

.3 FAULT RESET pushbutton,

.4 VFD RUN indicator,

.5 VFD STOP indicator,

.6 VFD FAULT indicator,

.7 LOCAL / REMOTE pushbutton with capability to transition without stopping, and,

.8 Parameter selection and programming capability.

.4 VFD's shall be provided with the ability to run from three separate locations: from a field-mounted control panel, from keypad (HMI) mounted on MCC/VFD door, and remotely via the CTG/HRSG control system (Remote).

.5 The VFD shall shut down in a controlled fashion when the local operator station is disconnected or Hand-Off-Auto switch is in "Off" position.

.6 Speed control mode selection as follows:

.1 Field HOA in "Hand": Speed set point from field-mounted 0-10VDC (or 4-20 mA) speed selector on local control panel.

.2 Field HOA in "Auto" and VFD Remote/Local in "Local": Speed set point from VFD HMI keypad setting.

.3 Field HOA in "Auto" and VFD Remote/Local in "Remote": Speed set point hard-wired from the CTG/HRSG control system.

.7 Intended Control Functionality (VFD supplier to confirm meets intent):

.1 Field HOA set to "Auto" and VFD keypad set to "Remote" enables the motor to be started, stopped and speed controlled by the CTG/HRSG control system. By default, this control will be via hard wired.

.2 Field HOA set to "Hand" and VFD keypad set to "Remote" enables motor to be started, stopped and speed controlled from the field operator panel.

.3 Field HOA set to "Auto" and VFD keypad set to "Hand" enables the motor to be started, stopped and speed controlled from the VFD HMI.

.4 When the field HOA set to "Hand" and VFD keypad set to "Local", the field "Hand" input will disable the VFD keypad start/stop and speed control functions and the VFD will only be controlled from the field control panel.

.39 VFDs shall support and include the appropriate communication module for remote monitoring and control via Profibus DP. All remote control and monitoring by the CTG/HRSG control system shall occur using hard wired signals. The supplier shall provide a Profibus DP data map at the time of shop drawings based on the signal requirements for the specific project.

2.5 ALTERNATE SUPPLY OF MOTOR STARTERS (NON-VFD)

.1 If the Supplier decides to supply starters instead of wiring to those supplied by the Contractor, the following clauses apply:

.2 The Supplier's standalone control panel shall have all control components such as motor starters, pushbuttons, selector switches, signal lamps, relays, etc. to run the system. Three phase, 60Hz power at 600 V AC and single phase 120/208 V AC is available by others as required to power Supplier's panel.

.3 Motor starters for low voltage motors shall be of the combination type with circuit breaker and contactor type with overload protection for direct-on-line service, unless specified otherwise.

.4 Supplier's motor starter circuit breaker disconnect or system circuit breaker disconnect shall be suitable for padlocking without opening the control panel door.

.5 Preference for motor starter control power from a control transformer provided with each starter. Alternatively, Supplier shall provide independent 120 VAC power supply, separately fused for each starter.

.6 Intelligent type motor controllers shall be used for all non-VFD driven three phase motors complete with embedded wired overload protection, ground fault detection, motor current monitoring and other programmable electrical protection features required for the controlled equipment.

.7 Where intelligent type motor controllers are not practical, starters shall as a minimum have ambient temperature compensated thermal overload protective element in each phase, and status wired back to the CTG/HRSG control system, to be monitored by the plant DeltaV control system.

.8 Where thermistors are used, tripping or alarming due to windings overheating shall be performed within the starter structure.

.9 The equipment enclosure shall meet the requirements of panels and enclosures, detailed within this specification, based on the area to be installed.

.10 External reset buttons shall be provided for thermal overload devices.

.11 Overload relays, circuit breakers and contactors shall be sized based on the load requirements.

.12 Ensure contacts are maintained with a voltage drop up to 35% of contactor coil rated voltage applied.

.13 Include a control station complete with HOA selector switch and indicating devices mounted within sight for all motors.

.14 Provide a red drive running indicator light mounted on the panel or starter.

.15 For reversing motors provide a red (forward) and separate red (reverse) indicating lights mounted on the panel or starter.

.16 Provide a green 'Stop' indicating light mounted on the panel or starter.

.17 Provide, at minimum, hard-wired signals between starters and the CTG/HRSG control system as follows:

- .1 Run permissive and/or Run-Stop command (120 V AC isolated contacts)
- .2 Input to the control system (120 V AC isolated contacts):
  - .1 Summarized fault (global alarm)
  - .2 Remote/Local mode selected
  - .3 System running indication

.18 For critical motors provide:

- .1 Ready input (to control system)
- .2 HOR Selected input (Hand and Remote positions to control system)
- .3 Overload Tripped input (to control system)
- .4 Running input (two inputs for reversing motors)
- .5 Run Command output (two outputs for reversing motors).

.19 Provide a minimum of two (2) normally open (NO) and two (2) normally closed (NC) spare auxiliary run contacts in addition to those required for seal-in and interlocking.

.20 Various HP rated FVNR (and FVR) NEMA size starters accommodating, magnetic contactor, solid state smart overload, motor circuit protector or shunt trip circuit breaker/disconnect, compartment door mounted LED lights for status indication, and control devices.

.21 All starters shall conform to EEMAC E14-1, half size starters not acceptable.

.22 All starters of size, type rating as indicated with components as follows:

- .1 Contactor solenoid operated, rapid action type.
- .2 Smart motor electronic overload protective device in each phase, manually reset from outside enclosure.
- .3 All power and control wiring to be terminated on terminals in each individual starter cubical.
- .4 Each starter wiring and schematic diagram located inside starter cubical in visible location.
- .5 Starters shall contain RTD / thermistor control relay and accessories, where shown on the drawings.
- .6 All full voltage starters (reversing and non-reversing) shall be intelligent (IT) type and connected and programmed to communicate on the facility Profibus DP network.

.23 Digital – Intelligent Starters

.1 Provide electromechanical type motor starters with coil control and overload integrated into a single or dual microcontroller.

.2 The motor starter shall operate over a temperature range of -40°C to 65°C and shall meet or exceed the following Standards and Certifications: ULC, CSA, NEMA ICS1, ICS2, ICS5. Devices shall meet Electromagnetic Compatibility (EMC) Requirements per EMC IEC 61000-4.

.3 Provide user selectable overload Trip Class of 10, 20 and 30 on each smart motor electronic overload protective device. To adjust factory defaults, Trip Class shall be manually adjustable.

.4 Provide a microcontroller with the following features:

.1 Monitors user control inputs (i.e., permissive, forward, reverse, force-to-remote, local reset, remote reset, test/test to trip). Control inputs shall be rated 24 VDC (3 - 5 mA) with a plug and unplug lockable control connector. Starters shall be provided with a 120 VAC relay interface for controls from field and DCS panel, where required and/or indicated on drawings.

.2 Operates an LED indicator which displays a flash sequence for thermal capacities over 70%, test button depression, trip indication, class setting, phase enablement/disablement, and microcontroller reset condition.

.3 Monitors 3-phase current into a common node. Provides Thermal Memory which shall be saved to non-volatile memory for safety purposes in the event of a power loss or removal and restore event.

.4 Controls an alarm output which shall be a solid-state open collector or emitter type output at 24 VDC, 250 mA and trip relay.

.5 Solve a first order differential equation for the actual motor heating model to calculate trip points.

.6 Provides an “alarm only” or “alarm without trip” mode for critical must run applications.

.7 Control Voltages: The starter control voltage shall be nominal 24 VDC from 20 to 28 VDC.

.8 Motor starters shall have replaceable fixed and movable contacts, Size 1 through 5.

.9 Motor starters shall accommodate auxiliary contacts per various maximum combinations of single and dual auxiliaries. Maximum number of circuits shall be six (6) for Size 1 through 4 and twelve (12) for Size 5 starters.

.24 Front mounting in section sized for the application. Circuit breaker, contactor, overload and through bus to be sized as indicated on drawings and specified herein.

.25 Class II, Type B, wiring.

.26 Monitoring must be accessible via the network bus: Profibus DP. Alternate method of monitoring is to hard wire to the CTG/HRSG control panel and allow access to this information through the communication link between the CTG/HRSG control panel and the DeltaV system.

.27 Built-in communications shall allow immediate access to status information, motor performance data, and diagnostics, as well as performing motor control functions. Diagnostic information to include: device, trip, warning status, time to trip/time to reset (thermal overload) and history of past trips.

.28 The vertical wireways for load and control conductors, extending full height of vertical sections, to be equipped with cable tie supports.

.29 Installation and wiring to units accessible with doors open and units in place.

.30 Motor circuit interrupter, motor protection type circuit breaker with operating lever on outside of enclosure and provision for:

.1 Locking in “OFF” position with up to 3 padlocks.

.2 Locking in “ON” position.

.3 Provision for preventing switching to “ON” position while enclosure door open.

.31 For each remote mounted power factor correction capacitor connected on the load side of the motor contactor provide outgoing terminals, where shown on the drawings.

.32 Smart Motor Overload protective device in each phase, manually reset from outside enclosure.

.33 Provision for remote electrical reset shall also be provided.

.34 Control transformer complete with primary and secondary fusing of sufficient VA to handle operating coil and associated controls.

.35 Identify each wire and terminal for external connections, with permanent number marking identical to diagram.

.36 Certification:

.1 The Supplier’s representative shall attend the commissioning of the combination starter and provide the Engineer with written certification that the smart overload has been properly installed and adjusted.

.2 After receipt of substantial performance certification, the warranty period shall commence.

.3 Cost of commissioning and certification to be included with the starter supply.

.37 Integration:

.1 Integrated starters in MCC structures shall match the MCC manufacturer’s standard line of starters. The starters shall be included in the supply package with the MCC and shall be factory assembled and tested prior to shipment to site.

.38 The device must be resettable everywhere – manual, remote, by the device level bus and automatic. Smart Motor Overload protective device must support and be able to provide diagnostics for the following types of starter circuits:

.1 Direct (non-reversing) starter.

.2 Reversing starter.

.39 The device must support all inputs and outputs shown on the drawings. Provide expansion modules as required to meet all I/O requirements. Device must support run time checks that can be set for the starting or stopping of motors. All controls and diagnostics to be accessible via the device level bus.

.40 Control and Signaling: If the field HOA switch is set to “Hand” position (manual operation), or if local control is selected by means of a local/remote switch, the network control commands must be ignored and the load can now be exclusively controlled via the local control station.

.41 The smart motor protection device must also have the capability to operate and function with the device level bus disconnected, on reconnection the device must become live on the network with all information available to the DCS, and this must be done without interruption to the process.

.42 The device to continuously inform the operator about the current operating state:

.1 Actual phase current in %.

.2 ON / OFF (Running/Stopped).

.3 Warning/Alarm.

.4 Faults (This includes device fault, and each external interlock fault, separately monitored).

.43 Settable current limits: to be supported, these current limits are to inform the operator about critical states in the system. For example, a current which is below the lower current limit setting could mean a dry pump situation. The overloading of a conveyor, for example, can be quickly detected by the display of ‘upper current limit exceeded’. To avoid an overload trip of the machine, the operator can take precise steps to change the working process, such as reducing the amount of material in the conveyor.

.44 The device is to be self-monitoring and if there is a fault, the device must switch to the safe state (OFF or be able to maintain operating state - monostable or bistable behavior).

.45 The device must have the capability to be checked during running – without switching off of the motor. The device must support graphical software for setup and further diagnostics, this to be included with the device, vendor to provide details on licensing and amount of copies to be permitted, all costs to be included.

.46 Current sensor or equivalent: Sized for each application, (single conductors).

.47 Mount in cubicle section and wire as per drawings.

2.6 MAIN DISCONNECT

.1 The Supplier shall provide a local main disconnect for each separate power distribution unit included in the Supplier’s scope per Canadian Electrical Code requirements.

.2 The main disconnect shall be an unfused safety disconnect switch rated for the maximum full load current of the equipment, located within sight of the equipment and as per the Canadian Electrical Code.

.3 The switch shall provide for padlocking in the open position.

2.7 DISCONNECT SWITCH

.1 Indoor process areas: Non-metallic CSA Enclosure Type 4X, compact, non-fusible, horsepower rated disconnect switch, size as required.

.2 Outdoor Process areas: Stainless steel CSA Enclosure Type 4X, non-fusible, horsepower rated disconnect switch, size as required.

.3 Hazardous Process areas: Non-metallic CSA Enclosure Type 7, non-fusible, horsepower rated disconnect switch, size as required.

.4 Provision for padlocking in on/off position by up to three locks.

.5 Mechanically interlocked door of disconnect to prevent opening when handle in ON position.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

.8 Provide equipment identification in accordance with Section 01 60 12.

2.8 ELECTRICAL PROTECTION AND CONTROL

.1 All circuits fed from packaged control panels, which are part of Supplier's scope, will be protected and controlled by the Supplier.

.2 The Contractor is responsible for installing and wiring all control stations for equipment within packaged equipment scope that are defined as being shipped loose. Supplier to wire and install all control stations for equipment within packaged equipment scope when the mounted point is located on the skid.

.3 All control stations shall be accessible from finished floor or platform whichever is more practical. Power and control devices shall be mounted at 1200mm above finished floor or platform.

2.9 CURRENT TRANSFORMERS (CTS)

.1 One current transformer is to be supplied and installed on each phase, by the turbine supplier.

.2 Secondary wiring of the current transformers shall be wired to a shorting block installed in the control cabinet of the turbine.

.3 CTs shall have short-circuit rating not less than 40kA at 4160V. They shall be capable of carrying the rated primary current for a period of one minute with the secondary windings open-circuited as specified in CAN/CSA-C61869-1/2/3standard. CTs must be sized such that they do not saturate at fault levels equivalent to 40kA.

2.10 CONTROL PANELS, CABINETS AND TERMINAL BOXES

.1 Electrical equipment to be mounted inside electrical / mechanical rooms shall have a minimum NEMA 12 rating.

.2 All equipment, not mounted in an electrical or mechanical room, shall be of weatherproof construction, unless specified otherwise, with a minimum NEMA 4X rating.

.3 Construct enclosure from fabricated steel of at least 2mm in thickness or heavy duty aluminum. Outdoor mounted or process area enclosures shall be constructed of stainless steel.

.4 Short circuit rating of industrial control panels to be a minimum of 65kA, series ratings of equipment within the control panels is permitted.

.5 The enclosure surface treatment, with exception of stainless steel, shall be painted with protective coating, color ASA61 Grey.

.6 The height of the enclosure shall not exceed 2,400 mm.

.7 All enclosures shall be equipped with SS hinged doors and hardware. The door shall be electrically bonded to the enclosure and hinged to open at least 120 degrees.

.8 Equipment intended to be accessed by the operator shall only be mounted on the front of the enclosure.

.9 Provide main power disconnect switch with fuses or a circuit breaker appropriately rated for the panel loads. Equip disconnects with a lock-off device suitable for padlocking.

.10 Each control panel and control cabinet to include LED lighting and a light switch within the control panel enclosure.

.11 Design circuits for easy fault finding, with isolation for servicing. It shall be possible to replace any device or apparatus without exposure to energized busbars or the live side of any main switch or isolator, and without removal or dismantling of other equipment.

.12 Provide all the necessary termination boxes for interfacing field wiring.

.13 Submit termination box details for approval. Ensure boxes are adequately rated and sized to accommodate field wiring terminal blocks.

2.11 PANELBOARDS

.1 If required within the design and supply of the proponent, panelboards may be installed on the electrical skid equipment is terminated to this board by the factory.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.3 Allow for area class requirements in this specification.

.4 Allow for off-skid power feeders to directly wire to the panelboard(s).

.2 600 V panelboards: bus and breakers rated for 35000 A symmetrical interrupting capacity or as indicated.

.3 250 V panelboards: bus and breakers rated for 10000 A symmetrical interrupting capacity or as indicated.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Two keys for each panelboard and key panelboards alike.

.7 Tin plated copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

.11 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation for panelboards.

.12 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.13 Nameplate for each panelboard type 1 engraved as indicated in Technical Specification 01180.

.14 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.12 GROUNDING AND BONDING

.1 Intrinsically safe (IS) circuits to have separate grounding circuits insulated from the panel.

.2 An instrument ground to be fitted and be insulated from the panel.

.3 Common ground bars to be connected to a ground point near the gland plate, as well as all metal parts of the panel including doors and handles.

.4 Braided ground strap to be installed for all doors and handles.

.5 Internal ground wiring to be stranded copper with 600 V, green/yellow PVC V75 sheathing.

2.13 POWER SUPPLIES

.1 Where packaged equipment contains components which require dedicated power supplies, power supplies shall be provided as part of the Supplier's package.

.2 The heating effect of power supplies shall be considered when calculating the overall heat load of the enclosure.

2.14 CABLE TRAY

.1 Not included in this supply package.

2.15 CABLING AND TERMINATION

.1 Each alarm, instrument and control device shall be wired back to terminal blocks mounted in the Supplier's control panel.

.2 Provide 20% spare volume capacity when sizing control panels and distribution boards.

.3 Provide control cables with a minimum of 20% spare cores.

.4 Run wiring in slotted wiring ducts fitted with snap on lids. Do not fill ducts to more than 75% of full wiring capacity. Where ducts are mounted upside down support wiring to prevent the duct lid being forced open by the weight of wiring.

.5 Where wiring ducts are not practicable, wiring shall be in looms using cable ties at suitable intervals.

.6 Segregate different voltages (AC, DC) and instrumentation circuits.

.7 Provide pressure type terminals and marking strips.

.8 Group terminal blocks according to instruments, control and voltage levels.

.9 Provide shorting type terminals for CT secondary wiring.

.10 Except for outgoing connection terminal blocks for wiring to The District's equipment, no more than two conductors to be terminated on any one side of a terminal. If there is a requirement for more than two conductors, terminals with jumper pins shall be used.

.11 No more than one wire to be connected to a terminal designated for external wiring.

.12 Wiring colour codes to comply with the following:

Cable / Wire Function		At Supply Label	At Equipment Label	Colour
LV AC supplies	Phase	A	U	Red

	Phase Phase	B C	V W	Black Blue
	Neutral	N	N	White
	Ground	PE	PE	Green
Control AC supplies	Active	L1	L1	Black
	Neutral	N	N	White
	Ground	PE	PE	Green
DC supplies	Positive	+	+	Red
	Negative	-	-	Black
Instrument loop signals	Positive	+	+	Black
	Negative	-	-	White
	Ground	PE	PE	Green / Yellow striped

.13 All terminals are to be numbered in accordance with wiring diagrams.

.14 Outgoing power connections to be connected to terminal blocks for connection by others are to be grouped horizontally near the bottom of the panel. Provide aluminum, undrilled, removable gland plates for large control panels or equipment junction boxes.

.15 Provide ferrules on each end of all wires for control.

.16 Provide numbered wire markers on each end of all wires with designations shown on design drawings. Wires to be of slip on and heat shrink type, with white insulating material and have black numerals. Reference Specification 01 60 12.

.17 Instrument intrinsic cable to be black sheathed with blue marking stripe as per ANSI/IEC standards.

.18 All conductors to be stranded, 98% conductivity copper, with 600V RW90 XLPE insulation, unless specified below. No aluminum conductor permitted.

.19 Branch Circuit Wiring: conductors smaller than No. 12 AWG not permitted for 120 Volt lighting, power or motor branch circuits.

.20 BX cable is not permitted.

.21 Teck Cable

.1 Cable: to CAN/CSA-C22.2 No. 131 Type Teck 90 Cable and No. 174 – Cable and Cable Glands for Use in Hazardous Areas .

.2 Conductors: sized as per Canadian Electrical Code.

.3 Grounding conductor: copper.

.4 Circuit conductor: copper, size as indicated.

.5 Insulation Type: Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.6 Inner jacket: polyvinyl chloride material.

.7 Armour: interlocking aluminum.

.8 Overall covering: thermoplastic polyvinyl chloride material, fire retardant rated and marked as FT4.

.9 Fastenings: One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.10 Channel type supports for two or more cables at 1.5 mm centers.

.11 Threaded rods: 6 mm diameter to support suspended channels.

.12 Wire rope: to support suspended channels.

.13 Connectors: Watertight approved for TECK cable in non-hazardous and corrosive areas, and putty type explosion proof seals in hazardous locations.

.14 TECK cable to be HL rated in hazardous locations.

.22 Drive (VFD) Teck Cable:

.1 To CSA C22.2 No. 123 – Metal Sheathed Cable.

.2 To CSA C22.2 No. 174 – Cable and Cable Glands for Use in Hazardous Areas.

.3 CSA designated Teck cable, CSA approved for open wiring, concealed or buried, and for use in Class 1, Zone 1 and Zone 2 hazardous locations.

.4 Vendor certified for VFD – drive connection to electrical motor constructed to provide a low resistance path to ground to reduce the effect of standing and common mode voltage.

.5 Conductors:

.1 Grounding conductor: three x Copper.

.2 Circuit conductors: Copper, size as per the Canadian Electrical Code.

.6 Insulation:

.1 1000 V chemically cross-linked thermosetting polyethylene rated type RW90.

.2 Sheath: continuous aluminum.

.3 Overall covering: Flame-retardant PVC jacket to CSA FT4.

.4 Product equal to Nexans DriveRx VFD.

.23 Instrumentation and Control Wiring

.1 Instrumentation wiring installed in conduit to be twisted pair shielded cables #16 AWG copper conductors minimum, 300 Volt insulation, 100% coverage aluminum mylar shield, bare tinned copper drain wire #16 AWG minimum with overall flame retardant PVC jacket.

.2 Where multi-conductor twisted pair shielded cables are installed on cable tray, each pair shall be individually shielded, and the cable assembly shall have an overall shield with an inner PVC jacket, aluminum armor and outer PVC flame retardant jacket rated 600 Volt.

.3 Control wiring to be type TR-64, #16 AWG tinned copper conductor.

.24 Hazardous Area Wiring and Fittings

.1 Where a process area is classified as hazardous as indicated on the drawings, requiring explosion-proof fittings, the following copper free aluminum (Crouse Hinds option suffix code –SA) equipment shall be installed:

.1 Breather-drains, to prevent condensation in conduit systems, Crouse-Hinds Type ECD.

.2 Conduit seals – Crouse-Hinds Type EYS or EZS.

.3 Conduit drain seals – Course-Hinds Type.

.4 Conduit unions – Crouse-Hinds Type UNY.

.5 Fittings – Crouse-Hinds Type LBY, LBH, GUA, and GUB complete with corrosion-free Epoxy Powder Coating.

.6 Conduit runs – rigid aluminum complete with corrosion-free Epoxy Enamel Coating.

2.16 ANTI-CONDENSATION HEATERS

.1 Anti-condensation heaters rated at 120 VAC will be provided with all motors rated 75 kW and above.

.2 Anti-condensation heaters rated at 120VAC will be provided for control panels and distribution boards located in process areas. Heaters will operate on thermostat or with power down relay.

.3 Operation of these heaters shall be from NC auxiliary contacts of the Supplier's motor starter.

.4 The rating of the heater such as wattage and current drawn shall be specified on the nameplate.

2.17 EQUIPMENT NAMEPLATE

.1 All electrical enclosures, equipment and devices to be identified with nameplates.

.2 Operating handles, meters, control stations, limit switches, proximity switches, sensing elements and other like devices to be provided with nameplates.

.3 Reference Specification 01 60 12 for further direction on nameplate requirements.

Part 3 Execution

3.1 GENERAL

.1 Reference other specification sections for execution of the contract.

3.2 GENERAL TESTING AND INSPECTION

.1 The equipment shall undergo factory acceptance testing in accordance with this specification and The District's standard specifications for quality requirements.

.2 A factory acceptance Inspection shall be submitted by the Supplier for review by the District and Engineer.

.3 The equipment shall satisfactorily withstand the tests specified below and any additional tests specified.

.4 The records of all tests and all relevant certificates shall be provided as required in the requisition document and this specification.

.5 Electronic devices shall be completely tested and burned-in before being assembled into the supplied panel or gear.

.6 The Supplier shall give two (2) weeks' notice prior to any test commencement unless defined otherwise.

.7 The District/Contractor reserves the right to inspect the equipment at the Manufacturer's work site prior to shipping to confirm compliance with specification.

.8 The Manufacturer shall ensure that all required documentation has been collated prior to the final inspection and testing.

.9 Acceptance inspection and testing shall be carried out on the entire assembly unless previously agreed by the Engineer and The District.

.10 The Supplier to make available power supplies, tools and skilled labour to enable the final inspection and test to proceed without undue delays.

3.3 CONDUITS, FASTENINGS AND CONDUIT FITTINGS

.1 Provide all aluminum conduit entering or leaving hazardous areas and equipment with Crouse-Hinds Type EYS-SA or EZS-SA copper free aluminum fittings to seal in accordance with applicable code rules and as shown on the drawings. Normally, the seal shall be adjacent to the equipment, but in the case of equipment that may be removed or maintained, such as motors, control stations, switches, receptacles and instruments, a union shall be located between the seal and the equipment. Care shall be exercised to ensure that all seals are made up in accordance with the manufacturer's instructions. Seal in vertical conduits shall be drain-seal type, with a universal breathing-drain installed.

.2 Where conduits penetrate from heated to cold area, seal conduit with approved vapor sealing compound.

3.4 TEST RECORDS

.1 The records of all tests and all relevant certificates shall be provided as required in the requisition documents and this specification.

.2 The test reports shall clearly and unambiguously present all relevant information of the tests. A functional description and definition of specification limits for the acceptance criteria shall be provided by the Supplier and noted in the test report.

3.5 VISUAL INSPECTIONS

.1 The following mechanical and visual inspections shall be performed by the Engineer:

.1 Quality of workmanship;
.2 Surface finish;
.3 Conformity with the approved Shop Drawings and Purchase Orders;
.4 Conformity and completeness of the data on the nameplate;
.5 Degree of protection of enclosure;
.6 Degree of protection within compartments with a view to safety;
.7 Insulation of the bus-bar system;
.8 Creepage distances and clearances;
.9 Correct mounting of components;
.10 Internal wiring and cabling system;
.11 Suitability of clamping, grounding and terminating arrangements for incoming, outgoing and auxiliary cables;
.12 Correct labelling for circuits and interlock systems;
.13 Grounding system.

.2 The Engineer may request additional tests to verify the integrity of supplied equipment

3.6 FUNCTIONAL TESTING

.1 Main circuits and auxiliary circuits shall be checked to verify compliance with approved schematic circuit diagrams.

.2 When solid-state relays or other electronic devices are fitted, Manufacturer shall produce evidence that the equipment or individual components have withstood a reliability test, including a ‘heat soak’ test for an agreed period of time.

.3 Insulation resistance tests shall be carried out between each phase, and neutral against ground, with the remaining phases/neutral connected to ground.

.4 Circuits shall be random tested (with a minimum of 10% of each type) for electrical operation, including the operation of their control and protective devices. Variations in the control supply shall be taken into account.

.5 Thermal relays shall be tested to verify Manufacturer’s final factory test results.

.6 Care shall be taken that panel(s) grounds and if applicable, neutral grounding, are appropriate for the connection of restricted or unrestricted ground leakage protection.

.7 Following all the above-mentioned tests the panel(s) and components shall be examined to ascertain whether any components have been damaged and that all parts are in satisfactory operating condition.

.8 Complete records of this inspection and tests, shall be compiled into one inspection document by the Manufacturer and a copy shall be sent to the Engineer for inclusion into the final Manufacturer’s Test Report (MTR).

.9 The Engineer reserves the right to attend other tests which may be agreed upon and to visit the Manufacturer's work site at any time, during normal working hours for inspection of the works.

.10 To facilitate the Engineer's attendance at the acceptance tests, the Manufacturer shall:

.1 Give the Engineer a complete detailed program for the tests, four (4) weeks prior to commencement of tests;

.2 At the same time fully described precise details as to how these tests shall be conducted and documented. Engineer shall approve the tests or direct such changes as are necessary within one (1) week;

.3 Confirm not less than 48 hours prior to the referenced factory tests that they are scheduled for execution; and

.4 The Engineer and the Manufacturer shall agree upon the format of documentation for the tests. They shall in any case be fully documented, related to detailed schematic drawings, and be sufficient to show without question, that the specified tests have been applied to all equipment.

END OF SECTION

Part 1 **General**

1.1 **SCOPE**

.1 This Section includes, but is not limited to, the furnishing of all materials, labour, equipment and services necessary for the shipment, protection and storage of the Goods.

.2 This section supplements recommendations or requirements from suppliers, manufacturers and information provided elsewhere in the Specifications for the shipment, protection and storage of the Goods.

1.2 **CARE**

.1 Package, ship, handle and store the Goods to prevent damage.

.2 Damaged items will not be permitted as part of the Goods except in cases of minor damage(s) that have been repaired to the satisfaction of the District. These minor repairs will be deemed acceptable only upon written confirmation by the District after the repair(s) have been performed.

1.3 **SHIPPING DOCUMENTATION**

.1 For each scheduled delivery, provide a written Notice of Shipment at least five (5) working days prior to the delivery of the Goods to the Delivery Point.

.2 Each Notice of Shipment shall include legible copies of the approved Shipping Document as specified herein.

.3 Submit a Shipping Document for each shipment.

.1 The Shipping Document shall clearly state the manufacture, contract number, and shipment number.

.2 Where more than one shipment is made, the shipment number shall be “Shipment 1 of XX”, “Shipment 2 of XX”, etc.

.3 Each Shipping Document shall include a detailed packing list and bill of materials indicating weights of package of item(s) and special unloading and handling instructions.

.4 Each item, package, or bundle of material contained on the detailed packing list(s) and bill of materials shall be tagged or marked as identified in the delivery schedule or on the shop drawings.

.5 Complete packing lists and bills of material shall be included with each shipment.

.4 The Shipping Document shall include a description of all packing material such as wood pallets, plastic, Styrofoam, cardboard, or other indicating approximate weights of each material.

.5 Provide written instructions to the District clearly indicating proper handling, protection, and maintenance of the Goods while stored at the Delivery Point.

1.4 TRANSPORTATION

.1 The Supply Contractor shall pay all costs of transportation and insurance of the Goods to the Delivery Point.

.2 The Supply Contractor shall suitably package all materials to facilitate handling and provide protection against damage from moisture, dust, handling, or other cause during transport from the supplier's and/or manufacturer's premises to the Delivery Point, and during storage thereafter.

.3 Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces that are damaged prior to receipt and acceptance of equipment at the Delivery Point shall be repainted by the Supply Contractor to the satisfaction of the District.

.4 Use stiffeners or bracing, where necessary to maintain shapes, and to give rigidity and support to the Goods and/or packaging during transport and storage.

.5 Deliver parts of the Goods in assembled or sub-assembled units to the maximum extent practicable.

.6 The Supply Contractor shall correct any damage in order to conform to the requirements of the Supply Contract before the Goods are stored temporarily or are incorporated into the facilities and pay the costs arising out of dismantling, inspection, repair and reassembly, as applicable.

.7 The Supply Contractor shall be responsible for unloading the equipment and materials, inventorying and the District for inspecting the delivered equipment and materials upon receipt at the Delivery Point.

END OF SECTION

Part 1 General

1.1 INTRODUCTION

.1 This specification outlines the minimum requirements for the design, fabrication, supply, testing and commissioning of Instrumentation and Control (I&C) equipment provided as part of a mechanical or process packaged system to be supplied by a Supplier for the Sooke Dewatering Project at Sooke, British Columbia.

.2 The equipment defined within this specification includes but is not limited to the controls equipment, control panels, instrumentation and tagging standards as required for the packaged system.

.3 The services defined within this specification includes but is not limited to the supply, factory acceptable testing, delivery to site, installation support, testing (lead), commissioning (lead), training (lead) and collection of all support documentation.

.4 This specification is complementary to Equipment Data Sheets, drawings and specifications that may form part of the tender documents.

.5 It shall apply to those items installed on equipment and those items supplied loose by the Supplier.

.6 Refer to Division 16 for specification of common electrical elements (wiring, raceways, power supply, etc.).

1.2 DEFINITIONS

.1 **Contractor**: Site Installation Contractors

.2 **Supplier:** Equipment or Process System material provider

.3 **The Owner**: District of Sooke; the end user

.4 **Engineer**: Equipment Specifier

.5 "When specified", "Where specified" or "As specified" shall mean information shown on the accompanying Data Sheets or drawings by the Engineer.

1.3 LANGUAGE AND UNITS

.1 All documentation shall be provided in English.

.2 All units of measurement shall be in Imperial units.

.3 Where a component or piece of equipment is manufactured using the International Systems of Units (SI units), the SI units should be shown as the primary dimensions, with the Imperial equivalent shown in brackets.

1.4 CODES AND STANDARDS

.1 The design and installation of all instruments shall comply with the rules and provisions of the latest editions and amendments of the Standards and Codes of Practice listed below.

Document No.	Standard Title
ASME PTC 19.3,	Temperature Measurement
ASME B 40.100,	Pressure Gauges and Gauge Attachments
ASME B 40.200,	Thermometers, Direct Reading and Remote Reading
ASME Section VIII,	Pressure Vessels, Division I
ASTM E230	Standard Specification and Temperature-Electromotive Force (EMF) Tables of Standardized Thermocouples
ISA-S5.1	Instrument Symbols and Identification
ISA-75.01-1985	(R1995) - Flow Equations for Sizing Control Valves
ISA /ANSI-MC 96.1	Temperature Measurement Thermocouples
ISA 20	Instrument Specification Forms
ISA 75.02,	Control Valve Capacity Test Procedures
ISA 75.04,	Face-to-Face Dimensions for Flangeless Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.08,	Installed Face-to-Face Dimensions for Flanged Clamp or Pinch Valves
ISA 75.08.03	Face-to-Face Dimensions for Socket Weld-End and Screwed-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)
ISA 75.08.04	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (Class 4500)
ISA 75.08.07	Face-to-Face Dimensions for Separable Flanged Globe-Style Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.15	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (ANSI Classes 150, 300, 600, 900, 1500 and 2500)
ISA 75.16	Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (ANSI Classes 900, 1500, and 2500)
ISA 75.22	Face-to-Centreline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (ANSI Classes 150, 300, and 600)
UL 508A	Standard for Industrial Control Panels
NEMA 250	Enclosures for Electrical Equipment
CEC	Canadian Electrical Code (latest edition)
API – RP551	American Petroleum Institute, Process Measurement Instrumentation
ANSI/ISA-7.0	Quality Standard for Instrument Air
ANSI B16.36	Steel Orifice Flanges

.2 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.3 Quality control is in accordance with the applicable International Standards Organization (ISO) standard.

.4 In addition to Codes and Standards listed above, the following requirements shall apply:

.1 All equipment and assemblies shall carry the CSA, cUL or equivalent mark approved for use by the local Safety Authority with an associated declaration of conformity.

.2 In the event that specific equipment does not bear an acceptable equipment certification, the Supplier shall obtain local review, inspection, approval and labelling by a certification agency such as CSA, cUL or equivalent that is acceptable to the authority having jurisdiction.

.3 The Supplier shall pay for all costs for local inspection and any equipment modification as directed by the certification agency to obtain approval.

.4 In case of a conflict between Standards, CSA Standards take precedence in the interpretation of the requirements over other Standards.

.5 The design and construction shall also comply with the requirements of all authorities having jurisdiction over the site for the type of equipment specified herein.

1.5 CONFLICTS BETWEEN DOCUMENTS

.1 Conflicts between referenced documents shall be identified to the Engineer in writing for resolution. In general, the order of precedence is:

.1 Diagrams and Schedules

.2 Specifications (equipment) and Data Sheet

.3 Purchase Order

.4 This specification

.5 Referenced applicable standards

.2 In the event of any conflict between the Purchase Order, Specifications, Codes and Standards or lack of clear definition as to the applicability of any specification or standard, Supplier shall obtain a written clarification from the Owner before proceeding. The Owner's response and / or instructions shall subsequently form part of this Specification.

1.6 SUPPLIER INFORMATION

.1 The Owner's approval of Supplier's drawings and documentation does not in any way relieve the Supplier of his responsibility to meet the above criteria.

.2 The Supplier shall submit sufficient information (pressures, temperatures, flow rates, specific gravities, corrosive conditions, controller set points, alarm set points, ranges, etc.) to permit The Owner to execute the necessary review and checking activities and to develop control narratives, interconnecting diagrams, and shutdown and security circuits.

.3 Supplier shall provide, and The Owner shall review, interface drawings for complete compatibility with Supplier's equipment, interfacing with The Owner's Control System and for safe functioning of the equipment.

1.7 DOCUMENTATION

.1 Document software or programmed logic in a format acceptable to the Owner. Submit format for approval. Relay Logic, both in PDF for review and in the native PLC logic after commissioning is an acceptable format.

.2 Provide drawings / data as referenced in the subsections below.

1.8 P&ID AND FUNCTIONAL DESCRIPTION

.1 Submit a "Piping and Instrumentation Diagram" (P&ID) showing all necessary instrumentation, pipe sizing and valve types. Include controller set points, alarms, shutdowns, PSV, and PCV settings.

.2 Depict instruments in accordance with ISA 5.1 and 5.3 using the assigned instrument tag number and the site standard tagging (available upon request).

.3 Submit a functional description of the system operation, including the control description overview, alarm and operative setpoints, response to abnormal conditions, normal and emergency shutdowns, normal control sequence(s) and start-up to clarify the controls depicted on the P&ID.

1.9 INSTRUMENT DATA SHEETS

.1 Provide an ISA formatted instrument specification sheet (ISA – S20) for each type of instrument proposed. Include normal, maximum, minimum operating conditions, all process data and materials, and a functional description where applicable.

.2 Each data sheet shall include a revision number, date and signature.

1.10 LOCATION DRAWINGS

.1 All field instruments and associated connections to equipment or process shall be shown in their proper locations on the following types of drawings:

.2 Piping Plans and Elevations; and

.3 Location Drawings.

1.11 INSTRUMENT INDEX

.1 Provide a complete Instrument Index that includes all Instruments supplied with the Packaged Equipment. Submit information in an Excel Spreadsheet and include as a minimum the following items:

.1 Tag number;
.2 Service description;
.3 P&ID number;
.4 Piping line information (material, size, commodity);

.5 Manufacturer;
.6 Model;
.7 Part number (complete selection digits, including selected options);
.8 Power supply voltage requirement;
.9 Plan Drawing Reference;
.10 Installation Detail;
.11 Specification;
.12 Setpoint;
.13 Instrument ranges;
.14 Power Supply;
.15 Hazardous Area; and
.16 Calibration range.

1.12 DESIGN CONSIDERATIONS

.1 Supplier shall be fully responsible for furnishing instruments and instrument systems, meeting the following minimum design considerations:

.1 Meets the design requirements of the Packaged Equipment;
.2 Optimum Operation of Process;
.3 Suitable Quality;
.4 Suitable materials and coatings for the environment and conditions;
.5 Availability of support and spare parts;
.6 Reliability and proven technology;
.7 Quality Construction; and
.8 Safe Operability.

.2 Provide sizing calculations (the use of computerized calculations is preferred) for flow devices, thermowell vibration, control valves, regulators, and pressure relief valves.

.3 The Engineer will review all sizing (based on information provided by the Supplier) prior to the Supplier purchasing the instrument. Review by the Engineer does not waive the Supplier's responsibility for suitable and safe design.

.4 Supply panel drawings for all panels supplied as part of the package. The drawings shall show equipment layout, dimensions, wiring, a bill of materials and tubing details. See Control Panels section below.

.5 Ensure that all instrumentation provided, that is directly wetted by process or utility fluids and is subject to pressure has a valid Pressure Registration Number.

.6 Provide instrument air usage requirements in m3/hr for each device requiring air. Use volume of air for a complete valve stroke closed to open.

.7 Provide standard catalogue data (including technical specifications, wiring details, and instructions for maintenance, operation, and installation) for all instrumentation provided. Highlight information relevant to the actual instrument being used.

.8 Supplier graphics and Control Objects functionality to comply with The Owner's standards (will be provided on request).

1.13 INSTRUMENT NUMBER AND TAGGING

.1 Label all field instruments with a 25 x 50 mm rectangular stainless steel labels stamped with the assigned tag numbers (6 mm high lettering). The Supplier shall affix the label to the instrument with drive pins or stainless steel wire in such a manner that it need not be removed for installation of the instrument.

.2 Label all panel mounted instruments with two lamacoid nameplates engraved with the assigned tag number. Fix one label to the front of the panel and the second on the backside of the panel door.

.3 Label all interior panel components with a lamacoid nameplate.

.4 Follow Owner standards (available upon request).

.5 Wire numbering: Consistent with nomenclature used in available sample drawings.

.6 All PLC I/O module wiring: Numbered according to I/O point base/slot/point assignments.

1.14 INSTRUMENTS INSTALLED IN HAZARDOUS AREAS

.1 All instruments and electrical devices that are fully or partially located within a hazardous area shall be suitably rated for the area classification.

.2 Conduit and cabling systems to instruments located in hazardous areas shall be in accordance with the CEC.

1.15 INTRINSIC SAFETY

.1 Intrinsic safety design methods will only be used where standard instrumentation is not available.

.2 Where intrinsically safe instruments are provided the supplier shall also provide a suitably intrinsic safety barrier. The complete system shall be approved as providing an intrinsically safe method of protection.

1.16 ACCEPTABLE MANUFACTURERS

.1 Where the equipment Supplier is not providing an independent Integrated Control System (ICS) with the Supplier's equipment, The Owner will determine the structure of the control system and the provider of the control system. The equipment Supplier is required to integrate this system into his equipment. Integration includes providing drawings,

documentation and any engineering assistance to The Owner's control system Supplier to allow for this integration.

.2 Provide instruments from those manufacturers listed on the preferred Supplier list in **Part 4**. Where a choice has been provided the Supplier shall source from the preferred manufacturer and if the functionality cannot be met then the Supplier will choose from the alternate manufacturer(s). The Supplier shall notify The Owner if a particular instrument type is not listed and request a list of preferred manufactures for that specific instrument type or measurement application. The Owner will review and approve any new manufacturers and append them to this list. The Owner is not obligated to provide an explanation if a particular product is rejected.

1.17 SUPPLIER RESPONSIBILITY

.1 The Supplier is responsible for the functionality and suitability of all equipment provided as a part of their scope supply, including equipment that is shipped loose for connection to the packaged system equipment.

1.18 SUPPLIER SCOPE

.1 Supply all instrumentation and control devices required to operate the package systems that either mounts directly on the equipment or is field installed and wired to the systems.

.2 Prewire all field mounted instruments and devices to terminals in NEMA 4X junction boxes.

.3 Make provisions in the packaged control systems to interface to the plant PLC system as defined in the equipment specification. Define the provisions for interfacing with external control systems. Details to include the method of communicating all signals including any applicable protocols and all recommend data points for safety and process control/monitoring.

.4 Provide onsite support to lead integration efforts of the equipment; this effort will coordinate with the site Contractor and the Client.

.5 Provide a testing program and site services to implement the testing of the control system (dry and wet) with the Contractor and the Client.

.6 Provide a commissioning program and site services to implement the commissioning program of the system with the Contractor and the Client.

.7 Provide training material, trainer, and allow six training sessions for operations staff (4 hours per session, three in total) and maintenance staff (4 hours per session, three in total). A classroom environment will be provided for the operations staff. Hands on training to be included in part of each sessions.

1.19 **MATERIALS**

.1 Instruments shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.20 **ELECTRICAL APPROVALS**

.1 Provide instruments and control devices rated for the area classification where the devices are to be installed.

.2 CSA labelling for all Control Panels, both fabricated in a shop and modified in the field during construction.

1.21 **RFI PROTECTION**

.1 Provide RFI protection of electronic devices in order to not exceed 0.1% full-scale error at one meter from a 5-watt 2-way radio for frequencies of 20-1000 MHz.

.2 All field mounted devices shall have adequate surge and transient protection.

1.22 **SUBMITTALS**

.1 Meet requirements of submittal package detailed as part of this overall submission.

.2 Include the following:

.1 Power distribution wiring diagram.
.2 PLC wiring diagrams including all I/O points.
.3 PLC code (PDF).
.4 Communication and remote I/O interface module wiring diagrams.
.5 Operator interface terminal (OIT) wiring diagram if applicable.
.6 Back panel and subpanel layouts showing location of panel-mounted equipment.
.7 Enclosure elevation drawing showing location of externally mounted equipment.
.8 Enclosure assembly diagram if applicable.
.9 Complete bill of materials.
.10 Equipment details for each component.

Part 2 **Products**

2.1 **DESCRIPTION**

.1 Provide one (1) centrifuge to dewater sludges at a municipal wastewater treatment plant. The centrifuge is to dewater wastewater sludge derived from aerobic digestion of SBR waste activated sludge.

.2 Provide PLC based control system to allow fully automatic unsupervised control of centrifuge and all ancillary components. Control system must be capable of interfacing

with Plant Control System (PCS) via hard wired interface for primary control (start/stop, run and common alarm status) and Ethernet/IP for secondary feedback (system specific alarms).

.3 Supply products modified as necessary by the manufacturer to provide the specified features and to meet specified operating conditions.

.4 Provide centrifuge capable of dewatering the feed sludge as described in 2.3.1.

.5 Provide centrifuge with scroll with adequate hydraulic and solids loading capacity to accommodate the sludge characteristics described in 2.3.1.

.6 The unit is to dewater continuously, or intermittently, without spillage of sludge or water beyond the machine envelope.

2.2 MATERIALS AND WORKMANSHIP

.1 All materials and equipment shall be new, of current manufacture and free from all defects and imperfections.

.2 Measurement and control devices in contact with the process medium shall be 316SS (stainless steel), except as otherwise noted in this specification. If stainless steel is not compatible with the process medium the supplier shall identify the deviation and propose an alternate material.

.3 Body material of all in-line devices shall be equal or superior to the vessel/piping material to which they are connected (i.e., pressure / temperature ratings, chemical compatibility, etc).

2.3 INSTRUMENT ELECTRICAL REQUIREMENTS

.1 All instruments to be watertight with conduit drains at low points, rated NEMA 4X (IP66).

2.4 INSTRUMENT WIRING

.1 Refer to Division 16 for specifications of common electrical elements (wiring, raceways, power supply, etc) for instrumentation and control devices.

.2 Wire sizes and cable types used for instrumentation and control devices are as follows:

.1 16 AWG, 7 strand, twisted concentric tinned copper wires shall be used for single pair and single triad conductors, wired with mylar tape shield.

.2 18 AWG, 7 strand, twisted concentric tinned copper wire shall be used for multi-pair and multi-triad conductors, wired with mylar tape shield.

.3 PVC insulation, 75°C to -40°C handling, rated at 300V and in accordance with section 4 of CSA-C22.2 shall be used.

.4 Shielding shall be 100% coverage by an aluminum-Mylar tape shield and drain wire. Drain wire shall be 18 AWG on single pair and single triad wires and 20

AWG on multi-pair and multi-triad wire. The aluminum-Mylar tape shall be in contact with the drain wire at all times.

.5 Multi-wire conductor cables shall have each pair or triad shielded, insulated and with a drain wire. Each cable shall have an overall shield and drain wire.

.3 Wiring and cabling shall be permanently identified with the instrument tag number and marked at junctions and terminals. Wiring on an equipment skid shall be terminated in a junction box. Junction box shall be located at skid edge. Individual conductors and drain wires shall be splice free from terminal to terminal.

.4 The signal wire colour code shown below is intended to apply to all wiring, including the Device Cable, the Home Run Cable and Panel Room internal wiring. The number in brackets indicates the Wire Subscript to be used where single conductors are used and the colour code cannot be applied.

.5 RTD extension wire shall be triads with aluminized shield tape and tinned copper drain wire.

.6 Wiring for different systems shall not share the same cables, terminal boxes or conduit. Supplier shall provide segregated terminal strips in local panels. The following systems shall be separated from each other:

.1 120/220 V AC supply circuit

.2 Low voltage instruments signals

2.5 WIRING COLOR CODING

.1 Color coding of instrumentation wiring is listed in the following table:

		Supply Label	Equipment Label	Wire Color
Control AC supplies	Power	H	BLK	Black (-1)
	Neutral	N	WHT	White (-2)
	Ground	G	GRN	Green
AC Controlled by Relay	Signal	S	RED	Red
DC supplies	Positive	+	BLU	Blue
	Negative	-	BLU/WHT	Blue w/ White Stripe
DC Controlled	Signal	S	BLU	Blue
Instrument signals 4-20 mA	Positive	+	RED	Red
	Negative	-	BLK	Black
	Signal und	SG	SG	Silver
Ethernet	Jacket			Yellow
HART (2 pair)	Jacket			Blue
	Positive Pr #1	+	BLU/WHT	Blue/White
	Negative Pr #1	-	WHT/BLU	White/Blue
	Positive Pr #2	+	ORG/WHT	Orange/White

		Supply Label	Equipment Label	Wire Color
	Negative Pr #2	-	WHT/ORG	White/Orange
Fibre Optic	Jacket		WHT	Orange

2.6 SIGNAL LEVELS

.1 Pneumatic signals shall be 3 – 15 PSI(g) or 5-30 kPa(g).

.2 Analog instrument and control device signals shall be 4-20 mA DC with HART protocol.

.3 Analog instrument and control device signals between packaged equipment and the plant control system shall be 4-20 mA DC.

.4 It is preferred that all instruments are loop powered when suitable instruments are available. If external power is required, the preference is 120 VAC. External power requirements shall be communicated to The Owner.

.5 Discrete signals such as switches and solenoids shall operate at 120 VAC and be powered through the control system. The preference is for FORM-C dry contacts with wetted voltage derived from the input device.

.6 Discrete Control shall operate at 120VAC and be powered through the control system. DC voltage will be allowed where applicable; ensure signals of different voltages are not run in common conduit (included those with high insulation ratings).

.7 Solenoids shall be ‘low power’ type, 4 watts or less.

.8 Communication between Supplier’s PLC and the plant PLC system will be by Ethernet based communications using Ethernet/IP protocols.

2.7 TRANSMITTERS

.1 Transmitters shall be equipped with LED or LCD backlit integral indicators.

.2 Process variable switches (low, high switch points) to be provided as programmable adjustable variables based on analog inputs\variables in the PLC. Minimize the use of standalone process alarm relays.

.3 Switches, where unavoidable, shall be single pole, double throw, hermetically sealed. Applications calling for both alarm and shutdown shall be separate switches in separate housings and have separate connections and isolation manifold to sensing point.

.4 All switches and relays shall have contact ratings of at least 120 VAC 0.5 amps. Shutdown output signals for solenoid valves shall be rated for 120 VAC, 2 amp loads.

.5 Electric interlock circuits shall be normally energized and use contacts opening to cause a shutdown. For alarm indication use normally open contacts that close on alarm.

2.8 WINTERIZATION

.1 Field mounted instruments, such as transmitters, gauges, etc., which are not suitable for use at -40°C shall be protected with a pre-molded instrument enclosure meeting the following requirements.

.2 The enclosure shall have a latchable cover and if the instrument is of the indicating type, a window where the indicator is visible through the window.

.3 Also a lamacoid label shall be affixed to the outside of the enclosure with the instrument tag clearly visible.

.4 An electric heater and thermostat shall maintain a minimum temperature of 10°C inside the enclosure.

.5 Where impulse tubing is located outside and is prone to freezing, prefabricated, heat-traced and insulated tube bundle shall be used.

2.9 INSTRUMENT AIR SUPPLY

.1 The maximum number of users downstream shall determine the instrument air header line size, including 20% spare. The chart below states the size of the header versus the number of users.

.2 Air Header Size and Number of Users:

.1 12 mm (1/2 inch NPS) maximum 4 users
.2 19 mm (3/4 inch NPS) maximum 10 users
.3 25 mm (1 inch NPS) maximum 25 users
.4 40 mm (1-1/2 inch NPS) maximum 80 users

.3 Provide a single point of connection for instrument air for each skid. From this point, an air header shall be run around the skid. Individual take offs will be run to within 24 inch of every instrument and include an isolation valve at the instrument. Each take-off from the header is to have an isolation valve.

.4 Every instrument requiring instrument air at a lower pressure than 120 PSI(g) to have its own filtered pressure regulator. If the Supplier prefers to use a single regulator to serve multiple users via a header, this regulator shall be dual redundant with individual isolation. In case of a common regulator, a pressure gauge and a relief valve are required on the low-pressure header.

.5 The main air header shall contain two pressure regulators in parallel, complete with parallel filters, a 114 mm (4½") pressure gauge with block valves but no bypass, and with a relief valve. The regulators and filters shall be valved so that one may be removed without interrupting service to the panel.

.6 Tubing to each instrument which is not equipped with a self-sealing disconnect valve shall be provided with a block valve and test tee for calibration purposes.

.7 Process leads to pressure instruments – 12 mm (½" OD) x 1.2mm (0.049" W.T.) 316 SS seamless tubing shall be used with Swagelok 316 SS fittings. Special materials may be required depending upon process conditions.

.8 Instrument air signal tubing shall be 6mm (¼" OD) x 0.8 mm (0.035" W.T.) 316 SS seamless with Swagelok fittings. Where instrument in question is subject to frequent maintenance or high vibration, vibration loops may be used or alternate tubing (e.g. Flexible armoured Teflon or Multi-Purpose hose such as Swagelok PB Series Push-On multi-Purpose Hose).

2.10 UNITS OF MEASUREMENT

.1 All engineering units used on the project shall be in Standard US units unless otherwise specified. This will apply to all calculations, drawings, data sheets, etc.

2.11 PRESSURE

.1 All pressure instruments shall be provided with a 19 mm (¾" NPT) x 12mm (½" NPT) isolation valve.

.2 Pressure instruments in steam service shall be provided with a 12mm (1/2 inch NPS), ANSI CL 800, globe type isolation valve with socketweld inlet connection and FNPT outlet connection.

.3 Each gauge or absolute pressure device shall be equipped with a two-valve manifold. Each differential pressure device shall be equipped with a five-valve manifold.

.4 Primary pressure elements shall be 316 stainless steel minimum for all pressure instruments, unless conditions of service require otherwise. Pressure containing parts constructed from aluminum shall not be used.

.5 For dirty, solidifying or corrosive process fluids, pressure instruments shall be equipped with a 75 mm (3 inch NPS) flanged diaphragm seal, rated to withstand the corrosive nature and temperatures of the process. A full port isolation valve and flushing connections shall be provided for each diaphragm seal.

.6 Local pressure gauges shall be installed to verify the functionality of the following instruments and equipment:

- .1 Relief valves
- .2 Regulators
- .3 Pressure transmitters
- .4 Pump suction and discharge
- .5 Exchanger nozzles
- .6 Other equipment as necessary

.7 Local pressure gauges for process services shall meet ASME B40.100. Further specifications shall be as follows:

.8 Gauge Design:

- .1 Minimum 115 mm (4.5") diameter
- .2 Solid front with blow-out back construction
- .3 Acceptable case materials – stainless steel or phenolic
- .4 White dial with black numerals and linear scale
- .5 Micrometer screw for pointer zero adjustment
- .6 Bourdon tube, tip and socket material shall be 316 SS
- .7 Gauges shall have a 12mm (½" NPT), male, bottom connection

.8 As a minimum, gauges in pulsating or vibrating service shall be filled with Dow Corning 200 fluid

.9 Gauges used in steam service shall be supplied with steam siphon to protect the gauge from heat damage.

.10 Movements shall be constructed of stainless steel. Movements shall be of the quadrant and pinion design or the helicoid arm and roller design.

.11 Gauge accuracy shall be 1% or better maximum scale reading. Repeatability shall be better than 0.5% of maximum scale reading. Gauges will be selected such that the normal process pressure falls between 30% and 70% of scale.

.12 Gauges shall be provided to withstand a pressure of up to 1.3 times the scale range. Gauge range shall exceed the set pressure of any related pressure relief device.

.13 Diaphragm seals shall be used for winterizing pressure gauges and corrosive services. Extended diaphragm seals can be used where there is a possibility of set up or to minimize fluid outside the pipeline. Material for diaphragm seals shall be compatible with the process fluids.

.14 Process gauges for low pressure application shall be as described in the preceding except that they shall have diaphragm sensing elements.

.15 Pressure gauge connections on vessels shall be flanged.

.16 Pressure gauge connections associated with heat exchangers shall be on the piping, not on the exchanger nozzles.

.17 In addition to the piping supplied isolation valve, each pressure gauge shall have a block and bleed calibration valve.

.18 Cooling fins shall be considered to reduce high process temperature effects on the gauges.

.19 Gauges used in service where pressure spikes and vibration are a concern shall be supplied with pressure snubbers.

2.12 DOOR SWITCHES

.1 A mechanical limit switch shall be installed on each exterior door to detect if each individual door is opened. All the contacts are to be wired and connected to inputs of the area PLC.

.2 Switches may be a magnetic type that is sensitive to a ferrous metal target. This alternate device shall be model 11-12110-00 as manufactured by Topworx.

.3 Alternative models from Topworx that are more convenient to mount or have better delivery are acceptable, but switches from other manufacturers are not acceptable. The targets are to be fabricated in the field.

2.13 ON/OFF VALVES

.1 Solenoid valves shall be supplied suitable for the applicable area classification. Coils shall be continuous duty (120 VAC) weatherproof encapsulated type. De-energization of the solenoid valve shall result in the valve moving to the fail safe position. Low wattage solenoids (4 watts or less) shall be utilized. Inline solenoid valves shall not be installed in lines larger than 25mm (1 inch NPS).

.2 On/off valves shall be specified as line size, full port, or reduced port depending on the process flow rate.

.3 Valves shall have Open/Closed position feedback. Where electrically operated valves are utilized they shall have both Remote / Local operation with status feedback and position feedback.

.4 Actuators shall be sized for 1.3 times the valve's maximum break-out torque at full rated ANSI differential pressure, and at the minimum instrument air supply pressure as specified on the project site data form. Motorized valves may alternatively be supplied with approval of the Engineer.

.5 On/Off valve body materials, including bolting shall be as per the corresponding piping class. Valve bodies shall have pressure—temperature ratings equal to or greater than the flange rating of the lines in which they are installed.

.6 Depressurizing valves shall be single seat globe-style valves if suitable for the service.

.7 Ball valves shall be of the bolted body design.

.8 As a minimum, inner valve trim shall be stainless steel.

.9 The finish on the flange contact face shall be specified the same as the matching pipe class.

.10 Control functions shall not be combined in a single valve with emergency shutdown and/or depressurizing functions.

.11 Actuators for Emergency Shutdown (ESD) valves shall be designed such that the valve fails in the chosen position whenever the motive force or signal is lost. The only exception will be motor-operated valves; these require Engineer’s approval.

.12 Emergency shut-off valves shall close within the time dictated by the process conditions, but in any case, in less than one second per inch of line size. Pipeline shut-off valves require different stroking speed to prevent severe hydraulic pulsations, which can damage equipment.

.13 Test documentation shall reference tag number.

2.14 MOISTURE DETECTION

.1 Provide moisture detection as required and to meet local code requirements.

2.15 CONTROL PANELS

.1 Local control panels associated with package units shall be designed and supplied by the Supplier. Front of panel layout, panel interior layout, and electrical wiring and/or tubing schematic drawings shall be submitted to the Engineer for approval. The Engineer approval shall be obtained prior to commencing work. Review by the Engineer does not waive the Supplier’s responsibility for suitable and safe design.

.2 Panels shall be of welded steel construction, framed, and braced with angle or channel steel as necessary.

.3 Cabinet will house an LED light, convenience receptacle and Print Pocket. All cabinets to be labelled per site standards.

.4 Doors shall be complete with piano hinge. Hinged doors shall utilize three-point, heavy duty latches. Doors shall be easily removable if not used for mounting of equipment. Panels to be mounted outdoors shall be provided with strip heaters and thermostatic controls, with power being fed from a separate external circuit. Panels shall have all cable entering from the side or bottom. If an outdoor panel is furnished with LED or LCD displays, the Supplier shall provide a sun screen to avoid direct sunlight on the panel face.

.5 Provide manufactures standard finish. Where special colors are required sandblast panels and then paint with two coats of primer prior and finish paint color. Use 316 SS unpainted panels in process areas and outdoor locations.

.6 Each panel, which is not permanently mounted by the Supplier on an equipment package, shall be provided with removable lifting lugs designed for lifting without deforming the panels.

.7 Panels and all equipment shall be suitably secured and protected to ensure that it will not be damaged in shipment or storage at the job site.

.8 Panels, including instrument components, electrical wiring, and devices, must conform to the electrical area classification where the panel is installed.

.9 Panel cut-outs and openings shall be gasketed and sealed to provide as minimum NEMA 4X (IP66) panel enclosure rating.

.10 Internal panel wiring shall utilize smooth, rigid, vinyl wireways as manufactured by Panduit. The wireways shall have removable closed top and slotted sides and be coloured White for DC voltages, and Grey for AC voltages. The wireways shall be limited to 50% capacity by cross-sectional area. All wiring shall be properly secured in wireways by the use of cable ties. Mixing of AC and DC wiring within the wireways is unacceptable.

.11 All signals and spare I/O shall be wired out to the terminal strips. Terminal blocks shall utilize DIN rail mounted single level terminal blocks, complete with fuse disconnect for power connections and knife gate disconnect for signal connections. Wiring terminating within these types of terminal blocks shall be connected without the use of crimp connections.

2.16 CONTROL SYSTEM REQUIREMENTS

.1 Process Control

.1 The District of Sooke utilizes a PLC/SCADA architecture based on Allen Bradley PLCs and iFIX 5.8 SCADA. The SCADA is used as the primary operator interface to monitor and control the entire plant. The SCADA will monitor and control the

packaged system. In addition, it collects and provides historical plant information. It is intended that the Dewatering processes are marshaled to common areas of the supplied skid, with detailed wiring and control narratives to be provided, allowing integration into the site control system.

.2 Where a Programmable Logic Controller (PLC) is provided for the package control system, it shall be supplied in accordance with the following requirements:

.1 The PLC rack shall include power supply unit, processor and I/O. Multiple racks may be used, but the system, when commissioned, shall include 20% installed spare I/O and 10% spare slots.

.2 A complete listing of all PLC hardware shall be provided.

.3 A copy of the programmed logic in native file format and printed or PDF copy of the PLC program shall be provided. Password to access machine level programming shall be provided to The Owner.

.4 The PLC make and model shall be Allen Bradley, Compact Logix-based. Individual components shall be chosen by the Supplier. Card types shall be standardized. Supplier shall provide a Bill of Material (BOM) as a shop drawing.

.3 Provide programming information as a detailed written description and/or Cause and Effect Diagram (C&E) showing the operating sequence and interlocks. Descriptions shall include tag numbers, operating parameters, set points, and start-up AND shutdown procedures.

.4 An HMI (minimum 12” dimension) will be provided to allow operation of the control system locally.

.5 120 VAC Discrete Inputs: The control panel will provide 120VAC to field equipment for signaling purposes only.

.1 Wires: Red.

.2 Field equipment: Equipped with 120VAC rated dry contacts and will operate the dry contacts. All Emergency Stop and other alarm Inputs shall be wired Failed-Safe (normally closed), where the de-energized circuit represents an alarm.

.3 For each dry contact, a pair of wires shall be installed and landed from the panel to the dry contact.

.4 One wire shall be hot (+) the other shall be used to return power back to the when the dry contact is closed.

.5 Both wires shall be continuous home-runs from field equipment panel to panel with NO intermediate terminations or splices.

.6 A sample drawing will be provided and followed.

.6 120 VAC or 24VDC Relay Outputs: The panel will be Supplied with120VAC or 24 VDC control power from the field equipment for control purposes only.

.1 Wires: Yellow to indicate foreign voltage.

.2 Discrete Output card will provide a dry contact to switch power on and off. Each dry contact will only have one function and serve only one piece of field equipment (for example, a single dry contact cannot be used to turn on a pump and used to illuminate a panel light).

.3 For each dry contact, a pair of wires shall be installed and landed from the panel to the field equipment.

.4 One wire shall be hot (+) the other shall be used to return power back to the field equipment when the dry contact is closed.

.5 De-energizing field equipment will consequently de-energize the 120VAC or 24VDC control power.

.6 Both wires: Continuous home-runs from field equipment panel to panel with NO intermediate terminations or splices.

.7 A sample drawing will be provided and followed.

.8 In general, the current for Allen Bradley output modules shall not exceed 2 Amps and never exceed the manufacturer's limitations. The A-B relay output module used on panels does not have on board fusing, therefore one of the 2 terminals provided for field connections, typically the line side, will be equipped with a 2A rated fast blow fuse.

.7 Terminal Approved Manufacturer.

.1 Weidmuller brand or equal.

Terminal Type	Weidmuller Cat. No.
Analog input (+), fused	WSI6
Analog input (-)	WDU2.5
Analog input shield	WPE2.5
Analog output (+)	WDU2.5
Analog output (-)	WDU2.5
Analog output shield	WPE2.5
Discrete input	WDK2.5*
Discrete output	WDU2.5
Digital output, fused	WSI6

All others	WDU2.5 or WSI6

.8 *Note: Discrete input terminal block assemblies require 2-tier terminals. The top tier is used for the individual inputs. The terminals on the bottom tier are ganged together using internal screw jumpers to form a voltage bus for wetting of field contacts.

2.17 PILOT DEVICES

.1 Selector switches, pushbuttons, and indicating lights: Heavy duty, oil-tight, 30mm, NEMA 13-rated.

.2 Selector switches and pushbuttons.

.1 Supplied with operator mechanisms, appropriate number of contact blocks, and any necessary legend plates bearing pertinent information.

.2 Contact block terminals: Labeled for identification purposes and contain no less than one single-pole, double-throw contact.

.3 Contact blocks: Heavy duty type rated for 10A breaking current at 120V.

.3 Stop and emergency stop pushbuttons: Red in color unless otherwise noted.

.4 Other pushbuttons: Black unless otherwise noted.

.1 Pushbuttons.

.2 Operation: Momentary.

.3 Switch operation for local-remote, auto-manual, and computer-manual selection: Maintained in all positions.

.4 Provided with flush head bezels.

.5 The following color code shall be used for the lenses of all indicating lights:

FUNCTION	COLOR	FUNCTION	COLOR
ON	Red	HIGH	Yellow
OFF	Green	AUTOMATIC	White
CLOSED	Green	MANUAL	Blue
OPEN	Red	LOCAL	Blue
LOW	White	REMOTE	White

FAIL	Yellow	POWER ON	White
TRIPPED	Yellow		

.6 Indicating lights: Push-to-test LED-type, rated for 120V operation.

.7 Selector switches, pushbuttons, and indicating lights: Allen-Bradley Series 800, Siemens Class 52, or equal.

2.18 GENERAL TESTING AND INSPECTION

.1 The equipment shall undergo Factory Acceptance Testing (FAT) in accordance with this specification and District Standard Specifications for Quality Requirements.

.2 Calibration and commissioning work shall be carried out by qualified technicians. The work shall be performed by the manufacturer's service representatives if so required.

.3 Demonstrate instrument calibration and loop checks. Each loop check shall be documented and successfully demonstrated to the Engineer for sign-off.

2.19 INSPECTION AND TESTING

.1 Refer to Division 16 for specification of Quality Control and Assurance requirements.

.2 Supplier shall perform a control system Site Acceptance Test (SAT) as part of the systems start-up services. Supplier shall provide testing procedure and documentation to be used during system start-up, for approval by The Owner.

Part 3 Execution (See Primary Specification)

Part 4 Preferred Suppliers

4.1 PREFERRED SUPPLIERS LIST

.1 Provide similar types of equipment from the same Supplier.

.2 Provide a list of proposed manufactures for the types of instruments and control devices being provide

.3 Provide equipment from manufacturers listed in the preferred Supplier table below.

Description	Preferred	Alternate
HMI	Wonderware AIS (12” or Greater) In Touch Version 11.1	None

Description	Preferred	Alternate
PLC	Allen-Bradley – ControlLogix L71 RS5000 Version 20.04	Allen Bradley MicroLogix 1400 (1766-L32BXBA), (small systems only)
Control Valves	Emerson(Fisher)	Samson Controls/Flowserve/ Metso (Neles-Jamesbury) / SVF Flow Controls/ DeZurik / Pratt / Milliken / Valmatic / Kennedy
Automatic On/Off Valves	Emerson	DeZurik / Pratt / Milliken / Valmatic / Kennedy Clarkson / Metso (Neles-Jamesbury) / SVF Flow Controls
Analysis	YSI or Hach	Endress + Hauser, ABB / CEM
Level Instruments (non-contact)	Endress + Hauser	(Rosemount)
Level Instruments (non-contact, point)	Endress + Hauser Vicronic Liquiphant FTL50)	Rosemount Vibrating Fork Level Switch 2120
Level Instruments (Style)	Pressure Vessels – Differential Chemical Tanks – Ultrasonic/Microwave Digesters - Microwave	
Level switches	Anchor Scientific P40N0	
Pressure switches	United Electric Controls	Ashcroft / Mid West Instruments / Dwyer-Mercoid
Flow switches (thermal)	Fluid Components International	ABB / Kayden / IFM
Pressure Transmitter (wetwell/similar)	Endress+Hauser (Waterpilot FMX 21)	
Pressure Transmitter (DP, Absolute))	Endress+Hauser (Deltabar PWD 55)	Rosemount (3051, 2051)
Pressure Gauge	Wika	Ashcroft / Weksler
Pressure Regulator	Fisher	Masonelian
Temperature Gauge	Wika	Ashcroft / Weksler
Temperature Transmitter	Endress+Hauser (iTEMP TMT 82)	Rosemount 214C Temperature Sensor w/ transmitter
Damper & Valve Actuators (electric)	Beck or Rotork	Auma / Flowserve
Damper & Valve Actuators (pneumatic)	Flowserve	Rotork / Beck / Numatics
Flow (Liquids) (Magnetic In-Line)	Endress + Hauser (Promag 400)	Rosemount 8750W, 8712E, Sparling Instruments, Bailey-F&P, Foxboro
Flow (Slurry, Sludge) (Non-contacting)	Flex-IM	Endress + Hauser / Emerson (Rosemount
Flow (turbine & Positive Displacement)	Brooks, ABB	Daniels, Flowline, Liquid Controls
Flow Gas	Endress+Hauser (t-mass 65F)	Sage
Combustible Gas	Sensidyne SensAlert ASI	MSA Ultimax XE
Combustible Gas Strobe	Killark SHBG-2-23R (C1D1)	

Description	Preferred	Alternate
Indicators (rate / flow)	Dwyer	Beka, Omron, Crompton
Density	Royce	Berthold / Process Automation (RSA) / Thermo-scientific / Toshiba
Solenoids	Asco	Rexroth / Parker / Festo
CCTV	Diamond Canapower	Canty / Northern Video / Schneider Electric
Warning Siren	Federal Signal	Claxon
Flashing Light (Xenon / LED)	Federal Signal	Edwards
Safety Relief	Farris	Tyco / Anderson Greenwood
Cable / Fibre Optic / Profibus	Belden / Anixter	Corning / Nexans / Optimum Cable Corporation
Terminals (Cabinets)	Weidmuller (W Series)	
UPS	Eaton (Ferrups)	Siemens Sitop
Surge Protection	Weidmuller SD323X	
Selector Switches, etc	Allen Bradley 800T	
Control Relays + Time Delay Relays	Weidmuller WDK	

END OF SECTION

Part 1 **General**

1.1 **GENERAL**

.1 Compile product data and related information as specified in each section appropriate for the Owner's maintenance and operation of products furnished under the Contract using the District's standard template for O&M manuals.

.2 Prepare operating and maintenance data as specified in this Section, and as referenced in other pertinent Sections of the Specifications.

.3 Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

.4 Refer to General Conditions re: holdback until complete compliance with the performance of the Work of this Section.

.5 Submit four sets of operating and maintenance manuals for all equipment valves, pumps and fittings described herein or as requested by the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, electrical inspection authority certificate and contract guarantee.

1.2 **QUALITY ASSURANCE**

.1 Preparation of data shall be done by personnel:

.1 Trained and experienced with knowledge in maintenance and operation of the described products.

.2 Completely familiar with requirements of the Section.

.3 Skilled as a technical writer to the extent required to communicate essential data.

.4 Skilled as a draftsman competent to prepare required drawings.

1.3 **FORM OF SUBMITTALS**

.1 Prepare data in the form of an instructional manual for use for Owner's personnel.

.2 In the format required by the District's standard template for O&M manuals.

.3 Submit two (2) complete copies for review. Once the District's comments have been incorporated, provide two (2) complete copies and an electronic copy. Provide the electronic copy in MS Word format and sections, such as, manufacturer's information may be in PDF format. O&M shall include "As-Constructed" drawings of the completed works provided in AutoCAD format complete with plot style table (CTB file), a DWF file(s) containing all drawings and a reproducible copy to NAD83 UTM coordinates.

.4 Format:

.1 Each system shall be bound in a separate binder.

.2 Size: 215 mm x 280 mm

.3 Cover: Identifying each volume with types of printed title "OPERATIONS AND MAINTENANCE INSTRUCTIONS".

.4 List:

.1 Title of Project

.2 Identity of general subject matter covered in the manual

.5 Binders:

.1 Two D-Ring binders with clear view pockets on front and side for each manual.

.2 Binders to fit 215 mm x 280 mm size paper.

.3 When multiple binders are used, correlate the data into related consistent groupings.

1.4 CONTENT OF MANUAL

.1 Neatly typewritten table of contents for each volume, arranged in systematic order where applicable following specification format.

.1 Contractor, name of responsible principal, address and telephone number.

.2 Names of subcontractors and suppliers.

.3 A list of each product required to be included, indexed to the content and the volume.

.2 Include only those product data sheets pertinent to the specific product. On each sheet clearly identify the data applicable to the installation or delete inapplicable references.

.3 Include the following information plus data specified:

.1 List all equipment which will require regular inspections and servicing.

.2 Maintenance instructions for all equipment and materials.

.4 Drawings: do not use Project Record Drawings as Maintenance Drawings.

.5 Adjusting tools, keys, spare parts: necessary adjusting tools, wrenches, brushes, keys, spares and the like as stipulated shall be provided at no additional cost to the Owner.

.6 Equipment and Systems:

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts;

.2 Panelboard Circuit Directories: provide electrical service characteristics, controls and communications;

.3 Include installed colour coded wiring diagrams;

.4 Operating Procedures: include start-up, break in and routing normal operating instructions and sequences. Include registration, control, stopping, shut-down and emergency instructions. Include any special operating instruction;

.5 Maintenance Requirements: include routine procedures and guide for troubleshooting, disassembly, repair and reassemble instructions; and alignment, adjusting, balancing and checking instructions;

.6 Provide servicing and lubrication schedule, and list of lubricants required;

.7 Include manufacturers printed operation and maintenance instructions;

.8 Include sequence of operation by controls manufacturer;

.9 Provide original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance;

.10 Provide installed control diagrams by controls manufacturer;

.11 Provide Contractor's coordination drawings, with installed colour code piping diagrams;

.12 Provide list of original manufacturer's spare parts, current price and recommended quantities to be maintained in storage;

.13 Include test reports as specified in Section 01400 – Quality Control or other sections;

.14 Additional Requirements: as specified in individual specification sections.

.7 Warranties and Bonds (Per General Conditions Article 34)

.1 Compile specified warranties and bonds;

.2 Co-execute warranty submittals when so specified;

.3 Review submittals to verify compliance with Contract Documents;

.4 Submit to Engineer for review and onward transmittal to the Owner;

.5 Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors;

.6 Number of original copies required: one (1) each.

Part 2 **Products - Not Used**

Part 3 **Execution - Not Used**

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section includes the general requirements for the supply, delivery and installation, testing and placement into operation of two progressive cavity pumps appurtenances as specified herein and as shown on the drawings. The progressive cavity pumps shall be suitable to feed sludge into the dewatering centrifuge.

1.2 SUBMITTALS

.1 Submit shop drawings and information in accordance with section 01 33 00 – Submittals.

.2 Pump data to include:

- .1 Manufacturer's name, type, model, year, capacity and serial number.
- .2 Manufacturer's specifications for all equipment supplied.
- .3 Performance curves, including differential head, capacity, efficiency, NPSHr, and brake horsepower.
- .4 Outline and arrangement drawings.
- .5 Cross-sectional drawings.
- .6 Materials of construction.
- .7 Details of operation, service and maintenance.
- .8 Recommended spare parts list with names and addresses of suppliers.
- .9 Manufacturer to provide spare parts for minimum service life target of 20 and 25 years for solids-bearing pumps and motors respectively.

.3 Motor data to include:

- .1 Manufacturer's name, type, rating, model, year and serial number.
- .2 Manufacturer's specifications for all equipment supplied.
- .3 The load, efficiency, speed, torque, current and power factor curves.

1.3 OPERATIONS AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 39 – Operating and Maintenance Data.

.2 Data to include:

- .1 Manufacturers name, type, model, year, capacity and serial number.
- .2 Details of installation, operation, service, lubrication and maintenance.

.3 Recommended spare parts list with names and addresses of suppliers.

Part 2 Products

2.1 GENERAL

.1 General

.1 Pumps shall be of the positive displacement, progressive cavity type, with a single helical metallic rotor rotating in a double helical elastomeric stator of twice the pitch length.

.2 Rotor and Internal Drive

.1 A single helical rotor, of circular cross section and fabricated from 316 stainless steel shall be driven in its eccentric path by either:

.1 A positively sealed universal joint and lubricated pin-joint fabricated from high strength steel with replaceable bushings. A 316 stainless steel shell shall cover the universal joint assembly to protect the elastomeric sleeve from damage by pumped material. The joint will be designed to ensure that no eccentric loads are imparted on the shaft seal.

.2 A sealed gear joint design utilizing a splined connecting rod and ball gear. The gear joint shall be enclosed and protected by a wire-reinforced elastomeric seal. The joint will be designed to ensure that no eccentric loads are imparted on the shaft seal. The joint shall be pre-lubricated.

.2 Stator and End-Cover

.1 Stator shall be of double-helix design and be chemically bonded to the inside of a carbon steel tube.

.2 Stator shall be of Buna-Nitrile construction, with a minimum Shore A durometer of 70.

.3 Stator shall be designed to prevent pumped material from contacting the stator bonding and tube.

.4 Stators shall be manufactured to size. Stators manufactured in long lengths and cut to size are not acceptable.

.5 Pumps are to be designed to pass 6 mm solids or larger.

.3 Casing

.1 The casing shall include 150# (ANSI B16) flanged connections for suction and discharge. The suction and discharge casings shall each be provided with at least one (1) drilled, tapped and plugged port, 13 mm (1/2 in.) diameter, for gauge or accessory connections.

.2 The casing shall be painted and constructed of thick-walled cast iron, free of defects.

.4 Seals

.1 All pumps to be provided with bearing isolators.

.2 Mechanical seals are to be designed for operation of pump between full vacuum (0 kPa absolute) up to 200% of the maximum expected operating pressure.

.5 Gear Reducer

.1 Reduce the shaft speed by means of a close coupled gear reducer mounted on the pump, Eurodrive, Nord or approved equal.

.6 Baseplates

.1 Pump shall be mounted on a fabricated, painted steel baseplate.

.2 Baseplate to have minimum 6 drilled holes for mounting to floor.

.7 Finishes

.1 All equipment shall be factory finished.

.2 Sub-contractor to prime and touch up damaged finishes to match original finish.

.3 Restore to new condition finishes which have been damaged too extensively to prime and touch up.

.8 Motors

.1 Provide all progressive cavity pumps with motors equipped with anti-reversal holdback gearing for prevention of backflow through standby pump.

.2 All motors to be rated for 24-hour continuous duty.

.9 Accessories

.1 Run Dry Protection:

.2 .1 The stator shall be fitted with a sensor sleeve and thermistor sensor. A controller shall also be provided and shall be installed by the contractor in the motor control center. The controller shall monitor the stator temperature and activate a shutdown and alarm sequence if the stator temperature reaches the adjustable limit on the controller. The controller shall include a manual local and remote reset function. Input to the controller shall be 1x115VAC/60 Hz.

.3 Over-Pressure Protection Switch:

.4 .1 Each pump unit shall be supplied with a silicone-filled isolation ring with a dual mounted gauge and single point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans and be constructed with a carbon steel body and fittings with a Buna sleeve. The switch shall be SPDT, NEMA 4.

.10 Acceptable Manufacturers

.1 Seepex.

.2 Wangen.

2.2 DEWATERING CENTRIFUGE FEED PUMPS

.1 Design Criteria

Number of Units	Two (2)
Pump Names	Centrifuge Feed Pumps 1 & 2
Liquid	SBR Municipal Residual Solids
Temperature (Deg C)	10 - 40
Specific Gravity	1.00
Solids Conc. (mg/L)	15,000
Apparent Viscosity Range (cP)	< 500
Normal Operating Flow Range (L/s)	8.3
Normal Operating TDH (m)	TBC
Drive Type	Variable speed
Power (kW / hp)	TBC
Motor Data (V / ph / hz)	TBC
Nominal Suction Diameter (mm)	TBC
Suction Connection Position	TBC
Nominal Discharge Diameter (mm)	TBC
Seal Type	TBC

Part 3 Execution

3.1 INSTALLATION

.1 Sub-contractor will supply necessary parts, labour and tools for complete installation of pumps.

.2 Competent personnel shall install equipment in strict accordance with the manufacturer's instructions. The Sub-contractor will not commence installation until such instructions have been received.

3.2 EQUIPMENT TESTING

.1 When equipment installation has been completed to the standards required by these specifications, the Sub-contractor shall arrange for the services of the equipment manufacturer's technical representative for a minimum of three (3) days.

.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, the Sub-contractor shall correct the deficiencies identified by the manufacturer's representative. The manufacturer's representative shall advise the Contractor's Consultant in writing that the installation has been checked and has been installed in accordance with the manufacturer's requirements.

.3 The cost of the equipment manufacturer's representative shall be borne by the Sub-contractor.

3.3 FINAL INSPECTION

.1 The Contractor's Consultant shall make final inspection only after the manufacturer's representative has advised the Contractor's Consultant in writing that the system may be operated.

.2 The Sub-contractor will, at his own expense, repair any irregularities or discrepancies identified during the examination. Costs associated with additional trips required by the manufacturer's representative for re-testing due to faulty installation shall be borne by the Sub-contractor.

3.4 TRAINING

.1 In addition to the time provided for equipment testing, the Sub-contractor shall provide for a minimum of eight (8) hours of on-site, formal training. The training shall cover all aspects of operation and maintenance of the equipment, including a full demonstration of rotor and stator disassembly / assembly.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 The supply, delivery, installation support, testing and commissioning of one (1) horizontal, solid bowl, continuous feed, scroll type, high solids centrifuge, complete with electric motors, local control panel, auxiliary equipment, and accessories as specified herein.

.2 Provide a dewatering system complete with:

- .1 Centrifuge machine
- .2 Main drive
- .3 Back drive
- .4 Vibration isolation and seismic restraint systems
- .5 Sludge cake and centrate discharge chutes
- .6 Sludge cake and centrate sampling ports
- .7 Spare parts and special tools
- .8 Flexible pipe connection at sludge inlet and dewatered sludge outlet
- .9 Local control panel complete with but not limited to variable frequency drives, disconnect switches, line and load reactors, PLCs, ethernet switches, 24 VDC power supply and operator interface terminal. The control panel will include the control of the centrifuge, PC pumps and polymer system.
- .10 All other components required, and ancillary devices required for a complete and operable installation

1.2 DESIGN AND REGULATORY REQUIREMENTS

.1 All supplied equipment shall be CSA approved.

1.3 SUBMITTALS

.1 Submit shop drawings, including electrical power and control schematics, instrumentation loop drawings and panel layouts in accordance with Section 01 33 00.

.2 Provide a list of components and materials which will be shipped pre-assembled, and parts list for the other components and materials. Weights and physical dimensions shall be indicated for each part, assembly, and/or package to be shipped.

.3 Provide descriptive literature for all ancillary items of equipment including the following:

- .1 Drawings showing connection points for feed sludge, flushing water and cooling water, and required field routing of piping to connection points indicated.
- .2 Details of the vibration isolation and seismic restraint systems demonstrating compliance with Clause 2.5.9
- .3 Empty and operating weights.
- .4 Location and height of centres of gravity for all components mounted on separate bases.

.5 Certification that the centrifuge vibration isolation system meets the performance requirements of Clause 2.5.9

.6 Parts list with recommended list of spare parts.

.7 Factory test results.

.8 Control schematics showing interfacing to controls and motor control centre equipment.

.9 Electrical Motors

.10 Engineered Shop Drawings for all Local Control Panels

.11 VFDs

.12 PLC components

.13 Operator Interface Terminal

.14 Line and Load Reactors

.15 24 VDC Power Supplies

.16 Terminals, Relays, Circuit Breakers and Fuses

.17 Ethernet Switches

1.4 COORDINATION

.1 Coordinate with other Divisions to ensure there are no conflicts in the work.

1.5 SHIPMENT, PROTECTION AND STORAGE

.1 Ship all equipment pre-assembled, to the degree practicable.

.2 Provide complete storage instructions indicating specific requirements necessary to prevent any weathering, corrosion, contamination, mechanical damage, freezing, or any other deterioration of components.

Part 2 Products

2.1 DESCRIPTION

.1 Provide one (1) centrifuge to dewater sludges at a municipal wastewater treatment plant. The centrifuge is to dewater wastewater sludge derived from aerobic digestion of SBR waste activated sludge.

.2 Provide PLC based control system to allow fully automatic unsupervised control of centrifuge and all ancillary components (valves, feed pumps and polymer system). Control system must be capable of interfacing with remote located pumps controls and Plant Control System (PCS).

.3 Supply products modified as necessary by the manufacturer to provide the specified features and to meet specified operating conditions.

.4 Provide centrifuge capable of dewatering the feed sludge as described in 2.3.1.

.5 Provide centrifuge with scroll with adequate hydraulic and solids loading capacity to accommodate the sludge characteristics described in 2.3.1.

.6 The unit is to dewater continuously, or intermittently, without spillage of sludge or water beyond the machine envelope.

2.2 ACCEPTABLE MANUFACTURERS

.1 The Owner will preselect the centrifuge equipment from one of the following vendors and notify the Contractor which equipment to procure under the General Contract.

.1 Alfa Laval Inc. (Alfa Laval)

.2 Andritz Separation Technologies Inc. (Andritz)

.3 Centrisys Corporation (Centrisys)

2.3 CAPACITIES AND PERFORMANCE

Provide centrifuge equipment capable of optimum performance within the following:

Number of Units		One (1)
Operating Period	h/d	6
	d/wk	2.5
	h/wk	15
Design Conditions		
Solids Feed Rate	kg/h	240
Maximum Volumetric Feed Rate:		
Sludge	L/s	8.3
Dilute Polymer Solution	L/s	0.65
TOTAL	L/s	8.95
Thickened Waste Activated Sludge - % VSS/TSS (by weight)	%VSS/TSS	75%
Stabilization Prior to Dewatering		Aerobic digestion
Chemical Precipitation		None
Performance Requirements		
Minimum Hydraulic Retention Time in Cylindrical Section of Bowl (*excluding conical section, based on maximum sludge feed rate only*)	seconds	21
Maximum Weir Depth		60% of bowl diameter
Minimum L:D		4
Minimum Solids Capture at peak solids loading and/or peak flow, each	%TSS	95%
Minimum Cake solids by weight	%DS	18%
Maximum dry polymer usage at peak solids loading and/or maximum flow, each	kg/TDS	10.0

.1 For the purpose of this specification, solids capture is defined as:

$$C(F - E)/F(C - E) \times 100$$

Where: C = percent dewatered cake solids (TS)
F = percent feed solids (TSS)
E = percent centrate solids (TSS)

.2 For the purpose of this specification, solids loading rate is defined as the peak solids production fed to a single centrifuge over a 6-hour period.

2.4 MATERIALS

.1 All wetted parts unless otherwise specified: AISI Type 316 stainless steel.

.2 Bowl shell: AISI Type 316/317 stainless steel.

.3 Scroll: AISI Type 304 stainless steel, as a minimum.

.4 Feed and discharge compartment walls: Polyurethane lining or sprayed carbide.

.5 All bolts, nuts, washers: AISI Type 304 stainless steel.

2.5 EQUIPMENT COMPONENTS

.1 General

.1 Provide centrifuge as a completely integrated unit designed for continuous and intermittent operation.

.2 Centrifuges shall be counter-current design.

.3 Polymer, in diluted form, will be pumped into the centrifuge feed sludge by variable speed positive displacement pumps.

.4 Dynamically balance each centrifuge prior to shipment.

.2 Bowl

.1 Provide solid bowl type centrifuges.

.2 The centrifuge bowl is a solid horizontal cylinder with a conical beach extension into which a scroll conveyor fits concentrically.

.3 Design the bowl to withstand all centrifugal forces encountered at the maximum bowl speed, with an adequate safety factor.

.4 Inspect all centrifugally cast components for cracks, shrinkage, porosity, or other defects by means of a liquid penetrant test.

.5 Certify that liquid penetrant tests were performed and the castings free of defects.

.6 Configure the centrifuge such that the pool depth is readily adjustable through the use of weir plates located at the large diameter end of the bowl.

.7 Design the weir plates to be readily accessible without the need to remove the centrifuge case top.

.8 Protect the bowl from wear by means of either a replaceable ribbed liner or longitudinal bowl strips. Material of construction to be AISI type 304 or type 316 stainless steel.

.3 Main Bearings

.1 Design the centrifuge to be supported by two main bearings.

.2 Main bearings to be spherical or cylindrical roller bearings.

.3 Main bearings to be grease or oil lubricated.

.4 Design main bearings for an ABFMA L-10 rating life of at least 100,000 hours.

.5 House main bearings in one-piece or split-type pillow blocks.

.6 Bearings shall be complete with 0.25% accuracy 100-ohm platinum RTDs.

.4 Conveyor

.1 Independently mount scroll conveyor concentrically within the centrifuge bowl.

.2 Equip the scroll conveyor with helical flights protected from abrasion by the following:

.1 Protect the edge and face of the conveyor against abrasion from the solids discharge end of the conveyor through the feed port area.

.2 Provide sprayed on tungsten carbide on edges of scroll over a width of 30mm.

.3 Design abrasion protection for the conveyor flights for a minimum of 15,000 hours of operation before refurbishment or replacement is required.

.3 Design the scroll conveyor to rotate at a slight differential speed to the bowl.

.4 Support the scroll conveyor by grease lubricated ball or roller bearings.

.5 Design the scroll conveyor bearings for an AFBMA L-10 rating life of at least 100,000 hours.

.5 Conveyor Backdrive

.1 Drive the scroll conveyor by a squirrel cage induction motor operated by either a variable frequency controller rated for constant-torque operation through a gear reducer or a hydraulic drive.

.2 Mount the backdrive system on a base separate from the centrifuge base or mounted in-line below the gearbox/speed reducer.

.6 Backdrive: Constant-Torque Rated Variable Frequency Controller Operated Squirrel Cage Induction Motor Backdrive Unit

.1 The backdrive system is to consist of a squirrel cage induction motor EEMAC torque rated for the load requirements, gear reducer, integral machine controls, and all appurtenances required to provide a complete, mechanical system.

.2 Gear Reducer

.1 Equip each centrifuge with a two-stage planetary gear / cyclo speed reducer that controls the differential speed between the centrifuge bowl and the scroll conveyor.

.2 Design the gear/speed reducer units with a torque capacity required to meet the specified service conditions with an adequate factor of safety.

.3 Select appropriate gear reduction ratio as required to perform under the specified service conditions.

.4 Design gears in accordance with AGMA Class 10 and Class 11 quality requirements.

.5 Case harden and grind the sun and planetary gears.

.6 Provide self-contained gear lubrication using high performance gear oil.

.7 Balance the gear box/speed reducer independently of the centrifuge.

.8 Provide the gear reducer with independent protection from high torque overload.

.9 A thermal overload protection system on the drive motor does not provide sufficient protection and is not acceptable for independent protection of the gear reducer.

.3 Design the backdrive system to provide infinite speed variation between the scroll conveyor and the bowl of the centrifuge.

.4 Allow for operation of the backdrive system in conjunction with the operation of the centrifuge in either a manual or automatic control mode.

.5 Provide monitoring of the backdrive torque loading and initiate shutdown of the centrifuge feed pumps upon detection of excessive torque, allowing a flushing and/or clearing of the internal solids inventory.

.6 The centrifuge feed pumps are manually restarted after a flushing cycle. Controls to allow feed pump to start automatically after a flushing cycle and initiate a shut-down sequence if flushing cycle occurs 4 times within a 60-minute period.

.7 In the event torque continues to increase, provide for centrifuge and feed system shutdown. Apply a brake to the pinion shaft to increase the conveyor's differential speed to a maximum to scroll the excess solids from the centrifuge as it coasts down.

.8 Mount the backdrive system controls in the centrifuge Main Motor Control Panel.

.9 Backdrive system controls consist of the pinion speed and torque indicators, speed adjustment potentiometers, and a forward/reverse direction selection switch.

.10 Design the backdrive control system to be capable of full four-quadrant control and operation, and rapid switching between modes to maintain the specified speed requirements.

.11 Backdrive Motor

.1 Provide TEFC energy efficient, horizontal, severe service duty backdrive motor rated for continuous operation at 480 VAC, 3 phase, 60 Hz.

.2 Motor rated for Supplier's standard speed at an altitude of 350m at 40°C ambient.

.3 Provide a tachometer generator rated at 50 VDC per 1000 rpm, or as normally provided by the Supplier compatible with the PLC input requirements.

.4 Provide motors with grease lubricated anti-friction ball bearings with a minimum AFBMA L-10 rating life of 60,000 hours.

.5 Connect backdrive motor to the pinion shaft of the differential gearbox through a V-belt drive or a cog belt.

.6 Backdrive shall be started by means of a variable frequency drive.

.7 Main Drive Motor

.1 Provide TEFC energy efficient, horizontal, main drive motor rated for continuous operation at 600 VAC, 3 phases, 60Hz.

.2 Main Drive Motor will be started by means of a variable frequency drive.

.3 Equip the Main Drive Motor stator windings with a minimum of three 0.25% accuracy platinum RTDs.

.4 Motor rated for Supplier's standard speed at an altitude of 350 m at 40°C.

.8 V-Belt Drive

.1 Configure the centrifuge main drive to be V-belt driven.

.2 Design the V-belt drive to allow for relative movements caused by the vibration isolation of the main drive base and the centrifuge base if separate equipment bases are used.

.9 Vibration Isolation

.1 Provide each centrifuge decanter and main drive with vibration isolators.

.2 Centrifuge decanter and main drive can be mounted on a common base and provided with vibration isolation or mounted on separate bases and isolators. Common base configuration is preferred.

.3 Provide 95% isolation efficiency.

.4 Provide vibration isolation equipment and devices by a single manufacturer with the exception of vibration isolators that are factory installed and standard equipment with the machinery.

.5 Size isolators at the manufacturer's optimum recommended loading. Do not load isolators above the limit specified in the manufacturer's literature.

.6 Provide a balanced set of isolators for each piece of equipment. Select all isolators in accordance with equipment weight distribution to provide the minimum static deflections stated above.

.7 Meet the minimum static deflection specified in the final installation, with each isolator having no less than 80% of the static deflection specified.

.8 Mark code numbers and colours on shop drawings, on each isolator, and on each base to ensure proper placement. Clearly tag all springs to show undeflected height and static deflection.

.9 If more than one type of neoprene element is used, clearly identify the durometer of each.

.10 Provide spring mounts complete with leveling devices, minimum 6mm thick neoprene sound pads, and zinc chromate plated hardware.

.11 Size neoprene sound pads for a minimum deflection of 1mm. Use dynamic stiffness for sizing elastomers and do not exceed 50 durometers.

.12 Maintain a nominal 50mm clearance below the equipment and the bases.

.13 Provide flexible piping connectors meeting the operating requirements, including nature of material, temperature, and pressure conditions, as well as the following requirements for vibration isolation:

.1 Provide flexible piping connectors as per manufacturer's standard for the intended service.

.2 Mould and cure flexible piping connectors in hydraulic rubber presses.

.3 No steel wires or rings are allowed as pressure reinforcement.

.4 Provide straight connectors with two spheres. Neoprene elbows manufactured with a single sphere forming the corner of the joint itself.

.5 Provide specification data and shop drawings for proposed alternate connectors for approval, if the requirements of this clause cannot be met due to the nature of the material conveyed.

2.6 CONTROLS AND CONTROL PANEL

.1 General

.1 Provide the dewatering centrifuge system with its own Local Control Panel (LCP), EEMAC 12 rated, including a programmable logic controller (PLC) and operator interface terminal (OIT). Components of the control system, operator interface and control panel to meet requirements stated in specifications 01 60 12 and 01 70 12.

.2 The centrifuge PLC shall have an Ethernet communications port and use the TCP/IP protocol.

.3 Control of the centrifuge and ancillary equipment shall be accomplished using a local vendor-supplied PLC located in the LCP. The use of separate controllers or processors for drive control operation is not acceptable

.4 PLC program shall be stored within an EEPROM or similar technology memory device on board the PLC. In the event of a failure or loss of memory of the PLC the control program shall be automatically restored from the memory module on power up of the PLC. Original copies of the PLC program code is to be provided on 3 CD's with a hard copy of the PLC programs and mapping of the memory registers.

.5 Design the control panel to provide control and monitoring functions for all related ancillary equipment for the dewatering process including but not limited to solenoid flush valves. Control of sludge feed pumps, polymer feed pumps, dewatered sludge conveyor will be provided by the Plant Control System (PCS) in response to remote requests from the centrifuge PLC.

.6 Motor starters (supplied by others) for the dewatered sludge screw conveyor shall be located inside the plant MCC. Isolated dry contacts for the start and stop of this conveyor shall be provided on the centrifuge's LCP (to be used if required). The LCP shall be capable of accepting inputs from the conveyor motor starter, to confirm its run status, and slow speed switch (SSL), to confirm rotation. These inputs shall be used for suitable interlocks in the centrifuge's LCP / PLC.

.7 Variable Frequency drives (supplied by others) for two (2) sludge feed pumps and one (1) polymer feed pump shall be located inside the plant MCC. Isolated dry contacts for the start and stop of the sludge feed pumps and polymer feed pump (i.e. "feed permissive" contacts) shall be provided on the LCP.

.2 Electrical Control Panel

.1 The centrifuge control panel shall be an EEMAC 12 freestanding enclosure. The panel shall include a through the door operated main disconnect that can be locked in the off position. Main power components shall consist of variable frequency drive controllers with short-circuit and overload protection for bowl and scroll motors. It shall include a common DC Bus to utilize regenerated energy from the

scroll motor for powering the bowl motor. The panel shall operate from a 480V AC, 3 phase, 60 Hz service and shall also include a control power transformer for auxiliary components. Main control components shall consist of programmable logic controller, control relays, and terminal points for interconnection with ancillary equipment. A phone modem shall be included in the panel and connected to PLC for remote diagnostics, data transfer and online analysis. Door mounted components shall consist of illuminated selector switches, mushroom head maintained emergency stop, and operator interface terminal (OIT).

.2 Provide phase loss and lightning/voltage surge protection device for each panel.

.3 Control voltage shall be 120V AC.

.4 Provide selector switches, pilot lights, pushbuttons, potentiometers and similar pilot devices for ease of operation and trouble shooting.

.5 Provide a local mushroom head-maintained emergency stop for the centrifuge wired in series with the panel emergency stop.

.6 The panel shall be constructed to UL 508 requirements, designed and built to provide the necessary components to safely run and control the centrifuge, three feed pumps, one polymer pump and one conveyor.

.7 An elapsed time meter shall be supplied and will be of six (6) digit, non-reset, register type with the last digit reading in tenths of an hour for the main motor and scroll motor suitable for panel door mounting.

.8 Provide all motor controllers for AC induction motors with integral thermal overload protection and motor circuit protection.

.9 All components in the control panel will be completely factory wired. All external control connection points will terminate on a terminal strip. There will be a minimum of 10% spare terminal connections supplied.

.10 Pushbuttons and pilot lights will be watertight, corrosion resistant supplied in accordance with specification Sections 01 70 12.

.11 Provide the panel with fault monitoring and alarm annunciation system complete with interlocks to related systems for system shutdown and run enable functions.

.12 Pilot lights will be supplied with appropriate colored lens caps.

.13 Control wire will be #14 AWG minimum: will conform to U.L. standards and will be type THW or MTW. Power wiring will be sized as required.

.14 Control wiring to be supplied in accordance with specification Sections 01 70 12 and 01 60 12.

.15 A ground lug will be supplied on the panel.

.16 Each wire segment will be numbered at each end in accordance with specification Sections 01 60 12.

.17 Nameplates will agree with the wiring diagram and be supplied in accordance with specification Sections 01 60 12 and 01 70 12.

.3 Control System Operation

.1 The operational procedure of the centrifuge shall be engineered such that minimal operator interaction is required. Each function shall be initiated with the push of its own button. Under alarm or "emergency stop" conditions, the

shutdown sequence shall be automatically triggered. The following is a step-by-step description of the sequence of operations.

.2 The centrifuge will be enabled / disabled by the PCS via a dry contact closure signal (relay or through PLC).

.3 The centrifuge will be started by depressing the centrifuge “START” button, thereby flashing the centrifuge "starting/running" light. The polymer and feed systems will be interlocked with the centrifuge controls to prevent their operation at this time.

.4 During start-up, the back-drive will be automatically set to a minimum speed to provide maximum scrolling of residual solids from the bowl. After a preset, timed interval, during which the bowl has reached full operating speed, the "starting/running" light will stop flashing and come on solid. The system checks the bowl speed and indicates that it is ready for operation assuming that no fault conditions exist.

.5 “Feed permissive” dry contact closure (relay or through PLC) signals will be provided to permit the Operator to initiate sludge and polymer feed to the centrifuge through the PCS. As process requirements vary, the backdrive speed will be infinitely adjustable via the touch pad on the "Operator Interface Terminal (OIT)" unit, which will maintain the set speed utilizing a closed loop under differential speed feedback system.

.6 The PLC monitors the operation of the centrifuge and provides a digital display of bowl speed, scroll speed, differential speed and torque, as well as other operational parameters on the OIT. The differential speed will be controlled either by a differential speed set point or a torque set point. While operating with a torque set point, the differential speed is automatically adjusted to maintain a constant torque; thereby, compensating for varying feed characteristics while optimizing residence time and separation. Set points for the differential speed and torque are entered via a numeric key pad/touch screen. In the fixed differential speed mode, the back-drive speed will be maintained while the torque is allowed to vary as process parameters change.

.7 After stable operation has been achieved, the auto-torque mode may be selected. In this mode, the back-drive torque will be maintained while the speed is allowed to vary, within preset limits, in order to maximize residence time. If torque begins to rise above the set point, the differential speed will be increased to scroll solids out of the bowl at a faster rate, thereby lowering the torque back to the set point.

.8 The shutdown sequence shall be triggered either with a single push of the "STOP" button, via a fault condition or via the centrifuge enable/disable contact used by the PCS. In any case, the system will disengage the sludge feed and polymer feed systems (using the “feed permissive” contacts), initiate the automatic flush cycle and disengage the main motor. The flush cycle shall consist of flushing the bowl with plant water during the coast down of the bowl. Concurrently, the scroll continues to convey solids to the discharge ports and out of the bowl.

.9 Provision shall be made for a pause mode of operation where the centrifuge will continue to run while the sludge and polymer feed pumps are stopped, and where the conveyor will stop after a specified time delay. This mode of operation will allow the cake receiving truck to be changed (approximately a 15-minute delay).

.10 Provision shall also be made for a programmed shutdown based on sludge production target achieved or set timer/ time.

.11 The back-drive will automatically be de-energized at the end of the coast down by a shutdown timer.

.12 Controlled Shutdown Sequence will consist of:

.1 Sludge feed pumps and polymer feed pump stopped.

.2 Main motor shut off allowing bowl to begin decelerating

.3 Water flush system timer started.

.4 Water flush system on.

.5 Timer for `scroll motor to stop' initiated.

.6 Water flush timer times out.

.7 Water flush system off

.8 Bowl decelerates to stop.

.9 Timer for “scroll motor to stop” times out.

.10 Scroll motor shuts off allowing scroll to decelerate and stop.

.13 Emergency Shutdown:

.1 The Emergency Shutdown (initiated either by the Emergency Stop push-button or by system alarms) will shut down the equipment simultaneously without going through the controlled shutdown sequence. After the condition is cleared and emergency stop push-button de-energized, the system shall require a safety-check and restarting by the operator.

.14 Equipment alarms:

.1 High Torque, high current, high vibration or high bearing temperatures will stop the polymer feed system and sludge feed pumps, alarm at panel and start bowl flush timer sequence. The scroll differential speed is also increased to maximum. When torque high alarm clears, bowl flush water sequence stops and the scroll differential speed resumes normal operation. Polymer feed system and sludge feed pumps can then be restarted.

.2 Torque high-high, high-high vibration or high-high bearing temperature will initiate the controlled shut down sequence and alarm at panel. After condition is cleared, operator to clear alarm via alarm reset push-button

.3 Equipment failure at the cake sludge conveyor will cause the sludge feed pumps and polymer feed pump to stop (using the “feed permissive” contacts) and start bowl flush timer sequence. Flush water timer to time out. After condition is clear, polymer feed system and sludge feed system can be restarted.

.4 Speed indication low will initiate controlled shutdown and alarm at control panel.

.5 Low relative/differential speed will initiate controlled shut down sequence and alarm at panel, after condition is cleared, operator to clear alarm via alarm reset push-button

.6 Thermal overload trip on main motor will initiate controlled shut down sequence and alarm at panel. After condition is cleared, operator to clear alarm via alarm reset push-button.

.7 Thermal overload trip on scroll drive will initiate Emergency shut down (all pieces of equipment simultaneously). After condition is cleared, operator to clear alarm via alarm reset push-button.

.8 High-high current on the back-drive will initiate Emergency shut-down. After condition is cleared, operator to clear alarm via alarm reset push-button.

.4 Control functions on front of control panel shall, as a minimum, include:

.1 Start/Stop, on/off controls of:

.1 Panel/Remote mode select
.2 Automatic Start-up
.3 Automatic Shutdown
.4 Centrifuge Drives
.5 Wash water Solenoid Valve
.6 Screw Conveyors
.7 Alarm Reset
.8 Bin Change mode
.9 Acoustic Alarm

.2 OIT status indication for:

Status

.1 Automatic Start-up "Starting up in Auto"
.2 Automatic Shutdown "Shutting down in Auto"
.3 Centrifuge "Running"
.4 Wash water Solenoid "Open/Closed"
.5 Polymer System "Running"
.6 FPS Feed Pump "Running"
.7 TWS Feed Pump "Running"
.8 Cake Conveyor "Running"
.9 Polymer Feed Pump "Running"

Alarms

.10 Emergency Stop "Fault"
.11 Bowl Drive VFD "Fault"
.12 Bowl Drive Motor Thermal "Fault"
.13 Back Drive VFD "Fault"
.14 Back Drive Motor Thermal "Fault"
.15 Back Drive High Torque "Warning"
.16 Back Drive High Amps "Warning"
.17 Back Drive High-High Torque "Fault"
.18 Back Drive High-High Amps "Fault"

.19 High Vibration "Warning"
.20 High-High Vibration "Fault"
.21 Low Relative/Differential RPM "Fault"
.22 Bowl Locked "Fault"
.23 Polymer System "Fault"
.24 Sludge Feed Pumps "Fault"
.25 Polymer Feed Pump "Fault"
.26 Screw Conveying System "Fault"
.27 High Bearing Temperature "Warning"
.28 High-High Bearing Temperature "Fault"
.29 Low/No Sludge Flow rate "Fault"

.3 Provide bypasses for all the above alarms in a password protected screen. Each by-pass must be automatically reset after a certain amount of time programmable through the OIT. This is to avoid any accidental permanent bypasses.

.4 Set point and measured parameter display of:

.1 Bowl Speed "RPM"
.2 Back Drive Speed "RPM"
.3 Back Drive Torque "Percent"
.4 Relative/Differential Speed "RPM"
.5 Bowl Speed Set Point "RPM"
.6 Back Drive Torque Set Point "RPM"
.7 Relative/Differential Speed Set Point "RPM"
.8 Vibration "mm/sec"
.9 Centrate side main bearing temperature Deg. C"
.10 Cake side main bearing temperature "Deg. C"
.11 Main Drive Current "Amps"
.12 Back-drive Current "Amps"
.13 Back-drive temperature "Deg. C"

.5 Alarms:

.1 Alarm conditions shall be indicated with flashing red indicators on the OIT alarm screen and shall cause alarm horn to sound and beacon to flash. Operator acknowledge pushbutton will silence horn and cause indicator lights and beacon to be steady on until alarm condition is cleared. Operating reset button will clear latched alarms. When no alarms remain present system start-up shall be allowed. When no alarms are present the OIT shall be indicate so by displaying alarm indicator text in green.

.2 Following conditions shall immediately shutdown the complete system in auto or manual:

.1 Emergency stop
.2 Bowl drive VFD fault
.3 Bowl motor thermal overload

.4 Back drive VFD fault
.5 Back drive motor high temperature
.6 Back drive high-high torque
.7 Back drive high-high current
.8 High-High vibration
.9 Low relative/differential speed
.10 Bowl lock
.11 High-High bearing temperatures

.3 Following conditions shall shutdown polymer and sludge feed in auto mode:
.1 High vibration
.2 Back drive high torque
.3 Back Drive high current
.4 Main drive high current
.5 Polymer system fail
.6 Sludge feed system fail
.7 Conveyor system fail
.8 High bearing temperature
.9 Bin change mode

.4 High vibration, high torque or high back-drive conditions will initiate a flush sequence the duration of which is operator adjustable through the OIT. If three consecutive high vibration, high torque or high back-drive current alarms occur within a one-hour time limit an auto shutdown sequence shall be initiated.

.6 Clean-In-Place (CIP):

.1 Provide a clean-in-place cycle that is manually initiated from the local control panel.
.2 Clean-in-place cycle includes provisions for rotating the scroll conveyor in either or both forward and reverse directions at timed intervals.
.3 During the cleaning cycle, flushing water is automatically introduced at high rates.
.4 An auto top shall automatically initiate the CIP.

2.7 PROTECTIVE COATINGS

.1 Shop prime and paint all equipment in accordance with Sections 46 90 00.

2.8 SPARE PARTS

.1 Provide the following spare parts for each centrifuge:

.1 One set main bearings and seals
.2 One set scroll bearing
.3 One set O-rings
.4 One thrust bearing
.5 One thrust bearing seal and lockwasher

.6 One spare set of belts of each size required

.7 Lube oil/grease for one year

.2 Provide the following special tools:

.1 One set disassembly tool

.2 One bearing puller

.3 Bowl/conveyor lifter and all special maintenance tools

Part 3 Execution

3.1 MANUFACTURER'S REPRESENTATIVE

.1 Arrange for a technically qualified Manufacturer's Representative to attend the installation work, train operating and maintenance staff and undertake the testing of the system for sufficient periods to ensure the equipment is installed, operated, and maintained in accordance with the Manufacturer's recommended procedures.

.2 The minimum periods of site attendance are identified in the following table along with the Form to be completed on each of these trips. A "day" is defined as eight working hours on site.

Item	Description	No. of Days per Trip	Form
1	Witnessing of Equipment Installation	1	100, 101,102
2	Operator and Maintenance Training (combined with Items 2 and3)	1	T1
3	Equipment Performance Testing	1	103
4	Equipment Performance Commissioning	1	104
5	Process Performance Testing	1	105
6	Follow-up Inspection (Optimization)	1	-
7	End of Warranty Inspection	1	-

.3 The total number of trips will depend on the Contractor's schedule. The cost of additional trips, to be determined by the Engineer, will be borne by the Contractor.

3.2 INSTALLATION

.1 The Supplier's Representative shall verify satisfactory delivery of the equipment by completing Form 100, illustrated at the end of Section 46 76 00.

.2 The Supplier's Representative shall instruct the Contractor in the methods and precautions to be followed in the installation of the equipment. Certify the Contractors' understanding by completing Form 101, illustrated at the end of Section 46 76 00.

3.3 INSTALLATION WITNESSING

.1 The Contractor shall ensure the equipment is installed plumb, square and true within the tolerances specified by the Supplier and as indicated in the Contract Documents.

.2 The Contractor shall ensure that the equipment is installed as required to provide satisfactory service.

.3 The Supplier's Representative shall cooperate with the Contractor to deliver a successful installation as documented by Form 102 illustrated in Section 46 76 00.

3.4 PERFORMANCE TESTING

.1 The Supplier's Representative shall ensure the equipment, including all component parts, operates as intended. The testing procedure is set out in Section 3.5.

.2 The Supplier's Representative shall cooperate with the Contractor to test the equipment as documented by Form 103, illustrated in Section 01 65 00.

3.5 EQUIPMENT PERFORMANCE TESTING PROCEDURE

.1 Startup

.1 Submit a detailed start-up procedure for approval.

.2 Provide site services of the centrifuge Supplier's Representative for the tuning, monitoring, inspecting, and starting of the centrifuge during the entire start-up procedure.

.3 Startup Procedure:

.1 Tune and adjust the centrifuge to begin initial start-up.

.2 Unless otherwise specified, sludge, polymer, water, and electric power will be provided for the start-up period.

.3 Subsequent to proper tuning, perform an initial thorough inspection of all system components, including electrical and instrumentation controls.

.4 Recommend suitable liquid polymer for the given sludge conditions.

.5 Subsequent to initial inspection and check-out, operate the centrifuge for a minimum period of 18 hours of continuous operation (3 days at 6 hours/day), or as feasible with the sludge inventory in the plant.

.6 The initial start-up procedure is deemed complete if no malfunctions occur during the 18 hours of continuous operation.

.7 If malfunctions occur during the 18 hours of continuous operation, perform and complete corrective action within 48 hours and restart the centrifuge for a minimum of 18 hours of additional continuous operation.

.8 The start-up procedure is then deemed complete if no malfunctions occur during the 18 hours of continuous operation. Form 102 will be signed upon the successful completion of the 18-hour test period.

.9 If malfunctions occur during the 18 hours of continuous operation, terminate the start-up period and perform and complete corrective action within 48 hours prior to requesting an additional start-up test.

.10 If an additional start-up is necessary, follow the procedures outlined above

.2 Testing

.1 Submit a detailed procedure and schedule for approval

.2 Begin testing only after completing the start-up procedure.

.3 Unless otherwise specified sludge, polymer, water, and electric power will be provided for the testing period.

.4 The procedure for testing is as follows:

.1 Operate the centrifuge for 6 continuous hours per day for a period of 5 consecutive calendar days.

.2 Demonstrate that the centrifuge performance during the testing period meets or exceeds the minimum performance requirements defined in these specifications.

.3 In the event of unacceptable performance, perform any supplemental testing, analysis, equipment adjustments, modifications, changes, or additions and request a retest of the unacceptable system at no additional cost.

.3 Sampling and Analysis

.1 Samples will be collected by the Supplier and analyzed by independent testing lab and District of Sooke staff during the testing period. Samples will be tested in accordance with the following:

.1 Centrifuge feed sludge: Total suspended solids (TSS); Volatile suspended solids (VSS); and Total solids (TS)

.2 Centrate: TSS

.3 Dewatered sludge cake: TS

.2 Representative samples will be collected for analyses everyone hour during the testing.

.3 In addition, centrifuge feed sludge instantaneous and cumulative flow rates, polymer usage, power usage, torque, and any other parameters necessary to demonstrate compliance with the performance requirements specified will be recorded.

.4 Submit a report summarizing the operating parameters assessed during the test period, recommending optimal setpoints and listing final testing data in concise tabular form at the conclusion of the test period.

.5 Upon the successful completion of the testing procedure, form 103 will be signed.

3.6 COMMISSIONING AND TRAINING

.1 A field service technician or start-up engineer of the Centrifuge Supplier shall commission the dewatering equipment.

.2 Local manufacturer’s representatives are not acceptable to perform these tasks unless authorized by the centrifuge Supplier.

.3 The field service technician shall certify that all equipment is properly installed and that the plant operators have been trained on proper operation and maintenance procedures

.4 The minimum recommended man-days / trips for installation inspection, system commissioning, and operator training shall be as follows:

.1 Inspection of installation: typically a minimum of one (1) man-day / one (1) trip.

.2 Start-up/system commissioning: typically a minimum of three (3) man-days

.3 Operator training: typically a minimum of three (3) man days

.5 Contractor and Manufacturer's Representative to be in attendance during commissioning of the process system that includes the equipment specified in this section to ensure the equipment functions as intended in the process system as documented by **Form 104**. Cooperate with the Commissioning Team in developing the Commissioning Plan for this equipment. Provide assistance as required for system programming, start-up and troubleshooting.

.6 The Supplier's Representative shall provide training to the Owner's Designated Staff in the proper operation and maintenance of the equipment as documented by **Forms T1**

3.7 FOLLOW-UP INSPECTION (OPTIMIZATION)

.1 After a period designated by the Owner (approximately 6 months after commissioning), a qualified Supplier's Representative shall visit the site to assist the plant staff in optimizing the centrifuge performance.

3.8 END OF WARRANTY INSPECTION

.1 After a period designated by the Owner (approximately 24 months after commissioning), a qualified representative will provide a follow-up inspection of the centrifuge installation.

.2 During this period, the following services will be performed by the centrifuge manufacturer's technical representative at their expense in the presence of designated plant staff:

.1 Replace the main bearings;

.2 Remove the scroll for inspection; and

.3 Optimize and adjust the centrifuge, as requested by Owner's Designated Staff.

END OF SECTION

CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100

We certify that the equipment listed below has been delivered into the care of the Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date

(Authorized Signing Representative of the Contractor)

Print Name	Signature	Date

(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name	Signature	Date

(Authorized Signing Representative of the Engineer)

CERTIFICATE OF EQUIPMENT INSTALLATION INSTRUCTIONS

FORM 101

I have familiarized the Contractor of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Supplier or Manufacturer)

I certify that I have received satisfactory installation instructions from the equipment Manufacturer or Supplier.

_____ _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Contractor)

CERTIFICATE OF SATISFACTORY EQUIPMENT INSTALLATION
FORM 102

I have completed my check and inspections of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

_____ _____
Print Name Signature Date
(Authorized Signing Representative of the Supplier or Manufacturer)

_____ _____

_____ _____
Print Name Signature Date
(Authorized Signing Representative of the Contractor)

CERTIFICATE OF SATISFACTORY SYSTEM OPERATIONAL TESTING
FORM 103

We certify that the Major Equipment listed below has been operated for at least three (3) successful days (with the last three (3) days to be consecutive) and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The piece of equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
Print Name Signature Date

(Authorized Signing Representative of the Supplier or Manufacturer)

_____ _____
Print Name Signature Date

(Authorized Signing Representative of the Contractor)

_____ _____
Print Name Signature Date

(Authorized Signing Representative of the Engineer)

I Acknowledge Receipt of the O&M Manuals, training and spare parts (**OM1, OM2, OM3, T1, and SP1 Forms** complete)

_____ _____
Print Name Signature Date
(Authorized Signing Representative of the District)

END OF SECTION

CERTIFICATE OF SATISFACTORY COMMISSIONING
FORM 104

We certify that the Sooke WWTP Centrifuge has been operated, tested and commissioned as per the Contract Documents for at least three (3) successful days (with the last three (3) days to be consecutive) and that the equipment meets its operational and performance criteria, including fully automatic controls. The treatment equipment is therefore classed as “conforming”.

PROJECT: _____

FACILITY: _____

_____

_____

_____

_____ _____

Print Name Signature Date

(Authorized Signing Representative of Contractor)

_____ _____

Print Name Signature Date

(Authorized Signing Representative of the Engineer)

_____ _____

Print Name Signature Date

(Authorized Signing Representative of The Town)

CERTIFICATE OF SATISFACTORY PERFORMANCE AND/OR GUARANTEED PERFORMANCE TESTING
FORM 105

We certify that the equipment listed below has been tested and meets the Performance and/or Guaranteed Performance Testing requirements as set out in the Work.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date

(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name	Signature	Date

(Authorized Signing Representative of the Contractor)

Print Name	Signature	Date

(Authorized Signing Representative of the Engineer)

Print Name	Signature	Date

(Authorized Signing Representative of The Town)

END OF SECTION

CERTIFICATE OF SATISFACTORY TRAINING
FORM T1

We certify that the Sooke WWTP designated Staff has received satisfactory training in the proper operation and maintenance of the equipment listed below.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date

(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name	Signature	Date

(Authorized Signing Representative of the Contractor)

Print Name	Signature	Date

(Authorized Signing Representative of the Engineer)

Print Name	Signature	Date

(Authorized Signing Representative of The Town)

END OF SECTION

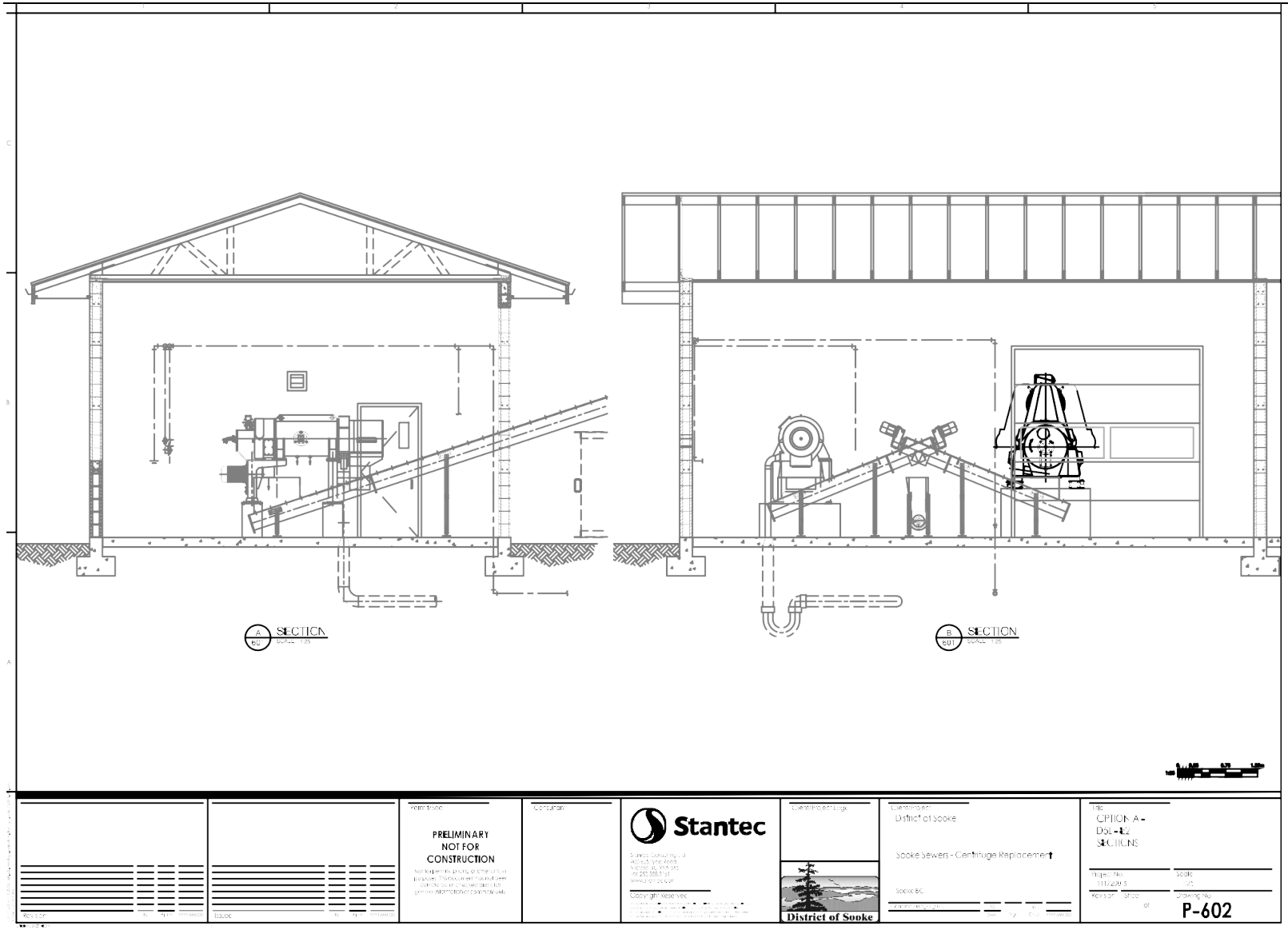


Figure 1. Dewatering Centrifuge drawing - E2 Sections

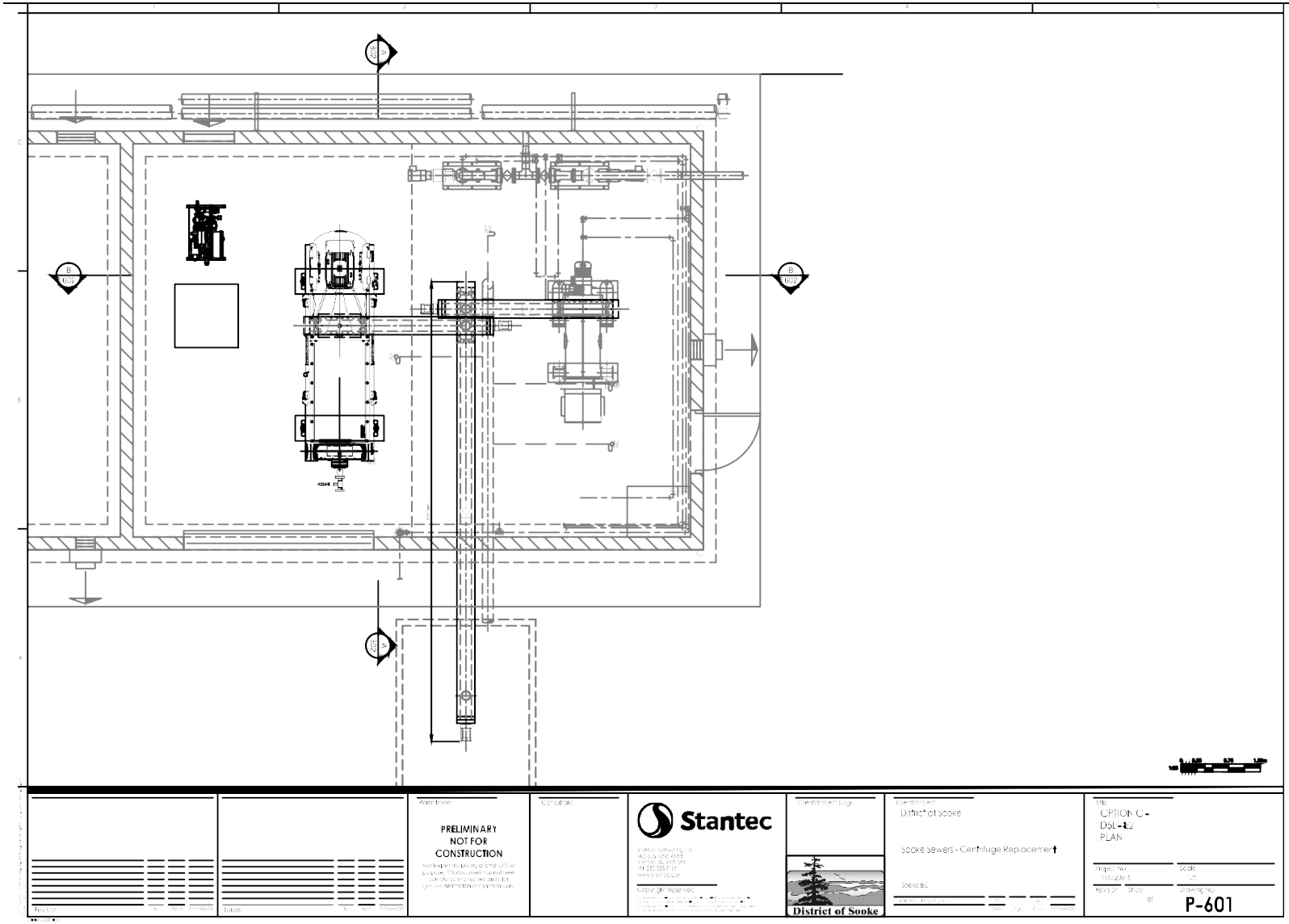


Figure 2. Dewatering Centrifuge Drawing - E2 plan

Part 1 General

1.1 DESCRIPTION

.1 This section includes the general requirements for the supply, delivery and installation, testing and placement into operation of one (1) Sludge Dewatering Polymer feed system, and appurtenances as specified herein. The liquid polymer feed system shall be suitable for feeding emulsion or dispersion polymers.

.2 Components of the polymer feed systems included, but are not limited to the following:

.1 Sludge Dewatering Polymer Feed System:

.1 One liquid polymer blending unit consisting of a progressive cavity pump to transfer neat liquid polymer emulsion or dispersion from a tote to the blending chamber and feed to the sludge dewatering flocculator. The polymer blending unit controls shall be integrated with the centrifuge supplier PLC.

.2 All interconnecting piping, valves, wiring, and accessories to connect the liquid polymer blending unit, totes and the pump assembly together to form a complete and workable chemical feed system.

1.2 RELATED WORK

.1 Division 1 – General Requirements

.2 Section 46 76 00 – Centrifuge Dewatering System

.3 Division 01 60 12 – General Electrical Requirements

1.3 SUBMITTALS

.1 Submit information for sludge dewatering polymer feed system, and as specified in the following Sections:

.1 Section 11 33 00

.2 Submit information for sludge dewatering polymer blend and feed system as follows:

.1 General layout, construction details, materials of construction and recommended spare parts list for the polymer blending unit.

.2 Polymer blending unit data as required in the following list:

.1 Rated capacity (GPH) of polymer blender

.2 Dilution water requirements (GPH)

.3 Suction and discharge pipe sizes (inch)

.4 Motor power

.5 Control system

.3 Dimensioned layout of polymer blending unit.

.4 Control panel details for polymer blender and metering pumps.

.5 Certified shop test results for the polymer feed system.

.6 Submit installation manuals before shipment of any equipment.

.7 Submit as part of the bound, indexed manual for all equipment, the installation, operation and maintenance manuals, 30 days prior to start up.

1.4 **MANUFACTURERS**

.1 The liquid polymer blending unit shall be the product of a company regularly engaged in the manufacture and supply of this type of equipment and whose equipment is of a design which has been in satisfactory service under similar conditions for not less than five (5) years.

.2 The liquid polymer blending unit shall be VeloBlend Model VM-2P-300 as manufactured by Velodyne, Promix as manufactured by ProMinent, Acrison Model 580 or reviewed equivalent.

Part 2 **products**

2.1 **DELIVERY AT PLACE (DAP)**

.1 The polymer system should be delivered at place (DAP) according to the following rules.

.2 The seller is responsible for arranging carriage and for delivering the goods, ready for unloading from the arriving conveyance, at the named place. (An important difference from Delivered At Terminal DAT, where the seller is responsible for unloading.)

.3 Risk transfers from seller to buyer when the goods are available for unloading; so unloading is at the buyer's risk.

.4 The District (buyer) is responsible for import clearance and any applicable local taxes or import duties.

.5 This rule can often be used to replace the Incoterms 2000 rules Delivered at Frontier (DAF), Delivered Ex Ship (DES) and Delivered Duty Unpaid (DDU)

2.2 **SERVICE CONDITIONS**

.1 The polymer feed systems shall be provided to feed polymer solution to the application point.

.1 The diluted sludge dewatering polymer solutions will be injected into the thickened sludge at upstream of the sludge flocculation tank to assist the centrifuge dewatering process. The polymer feed rate is normally determined based on the sludge flow rates and sludge density.

.2 Sludge dewatering polymer will be delivered in 275-US gallon (1,141 L) totes supplied by the chemical supplier and stored in the polymer room and sludge dewatering room.

2.3 GENERAL

.1 The sludge dewatering polymer system shall be supplied with one polymer blending units adjacent to the storage totes.

.2 The polymer system shall be an integrated package, pre-piped and pre-wired as specified herein.

.3 The metering pumps for polymer shall be capable of pumping polymers with apparent viscosities of up to 45,000 cps.

.4 The system electrical requirement shall be 120 VAC.

2.4 SLUDGE DEWATERING POLYMER SYSTEM

.1 The neat polymer will be transferred to the dilution blender by the metering pumps. Water will be supplied to the dilution blender simultaneously in proportion to the chemical flow to dilute the polymer solution to a concentration of 0.1 to 0.5 %. The dilution ratio shall be adjustable from the control panel of the blending system.

.2 The polymer feed equipment shall be skid mounted and shall include diaphragm metering pumps and polymer dilution blenders as specified below, and complete with piping, accessories, and instrumentations.

.3 Piping design shall allow the system to bypass the dilution blender and feed the neat polymer directly to the injection point.

.4 The dilution blender shall be designed for complete and thorough mixing to provide a diluted polymer solution without fish-eyes and without degradation of the long-chain polymer molecules.

.5 The dilution blender shall have a stainless-steel solenoid valve for ON/OFF control of dilution water, and a rotameter-type flow indicator/regulator equipped with an integral rate-adjusting valve. The rotameter shall be rated to handle the water flow rate specified herein for the various services.

.6 A flow sensor shall be provided for each system to shut down the polymer make down system and centrifuge dewatering system upon water flow interruption.

.7 Controls:

.1 A control panel integral to the systems frame shall be provided. The enclosure shall be rated NEMA 4X and constructed of FRP. The control panel shall consist of all digital displays, potentiometers, switches, lights, relays, and other control devices required for a complete operable system. The control panel and all components shall be industrial duty. All skid mounted electrical components interconnected to the control panel shall terminate at numbered and labeled terminal blocks. The terminal blocks shall be sized for 14 ga. wire. Wires shall be neatly run through wire race-way and numbered with shrink tubing type labels. Adhesive labels shall not be used. The control panel shall be positioned such that there are no obstructions in front of the control panel per related NFPA requirements.

.2 Power: 120 VAC, 1Ph, 60/50 Hz. A circuit breaker on the main control circuit and on each motor shall be provided as manufactured by Allen Bradley or equal. Fuses shall not be used for circuit protection.

.3 Operator Interface – Discrete Selector Switch:

.1 System ON / OFF (reset) / Remote

.2 One-Turn Potentiometer – Mixer Speed

.3 Stroke Length / Stroke Speed Adjustment (located on diaphragm metering pump)

.4 Status / Alarm Indicators:

.1 Main Power ON

.2 System running

.3 Display of Metering Pump Rate (located on diaphragm metering pump face)

.4 Low Water Differential Pressure Alarm

.5 Low Polymer Flow Alarm

.5 Inputs (signals by others):

.1 Remote Start / Stop (discrete dry contact)

.2 Pacing Signal Based on Process Flow (4-20mA)

.6 Outputs:

.1 System Running (discrete dry contact)

.2 Remote Mode (discrete dry contact)

.3 Common Alarm (discrete dry contact)

.8 Rp Ratio Controller

.1 The controller shall be PLC based with a minimum 5.7" TFT touch screen. Systems that rely on microprocessors and or alphanumeric displays shall not be considered.

.2 Operator Interface – 5.7" Minimum TFT touch screen with the following features as a minimum:

.1 LOCAL / REMOTE start/stop mode select:

.1 LOCAL start/stop mode: System shall run based on operator input from touch panel start/stop push-button.

.2 REMOTE start/stop mode: System shall start and stop according to the state of remote dry contacts (closed = run, open = stopped).

.3 MANUAL / WATER MASTER / PACED POLY RATIO operational mode select.

.1 MANUAL mode: The desired water flow is set manually using increase/decrease push-buttons on touch panel. The desired polymer flow is set manually using increase/decrease push-buttons on touch panel. Solution concentration defined by water and polymer settings.

.1 MANUAL mode run screen features:

.1 Water control increase/decrease push-buttons.

.2 Water flow rate (GPH) display.

.3 Polymer control increase/decrease push-buttons

.4 Polymer flow rate (GPH) display.

.5 Solution concentration (% poly) display.

.6 Total solution flow rate (GPH)

.2 WATER MASTER mode:

.1 Desired water flow is set manually using increase/decrease push-buttons on the touch panel.

.2 Polymer flow adjusts automatically to maintain operator desired solution concentration. Desired solution concentration is adjusted manually using increase/decrease push-buttons on touchpanel.

.3 WATER MASTER mode run screen features:

.1 Water control increase/decrease push-buttons.

.2 Water flow rate (GPH) display.

.3 Polymer flow rate (GPH) display.

.4 Solution concentration control increase/decrease push-buttons.

.5 Solution concentration (% poly) display.

.3 PACED POLY RATIO mode:

.1 Water flow adjusts automatically to maintain operator desired solution concentration.

.2 Polymer flow paced by remote 4-20mA (supplied by others).

.3 Desired solution concentration adjusted manually using increase/decrease push-buttons on touch panel.

.4 PACED POLY RATIO mode run screen features:

.1 Water flow rate (GPH) display.

.2 Remote pacing signal level (mA)

.3 Polymer flow rate (GPH) display.

.4 Solution conc. Control increase/decrease push-buttons.

.5 Desired solution concentration (% poly) display.

.6 Solution concentration (% poly) display.

.4 Help Screens:

.1 For each mode of operation

.5 Alarm screen features:
- .1 Indication of alarm
- .2 Description of recommended corrective action
- .3 Reset
- .4 Alarm history
- .5 Set-up screen features:
- .6 Semi-auto pump calibration
- .7 System flush settings
- .8 Auxiliary alarm user programming mode

.6 Discrete Selector Switch & System Indicator:
- .1 Main Power ON /OFF Switch
- .2 Main Power ON indicator

.7 Inputs (signals by others):
- .1 Remote Start / Stop (discrete dry contact)
- .2 Pacing Signal Based on Process Flow (4-20mA)

.8 Outputs:
- .1 System Running (discrete dry contact)
- .2 Remote Mode (discrete dry contact)
- .3 Common Alarm (discrete dry contact)
- .4 Polymer Pump Rate (4-20mA)

.9 System Skid:

.1 The system's frame shall be of rugged 304 stainless steel construction. No mild steel shall be used. All piping shall be rigidly supported.

.2 Under no circumstance shall the pump suction exceed 125mm from the bottom of the skid for progressive cavity pumps and 300 mm from the bottom of the skid for diaphragm pumps.

.10 Accessories:

.1 Tote Accessories

.1 Provide a polymer tote pump suction assembly. The assembly shall include quick disconnect cam-lock fittings, a 25 mm full port ball valve, and 5 m of 25 mm braided PVC hose.

.2 Provide a polymer tote truck designed to transport up to 375-gallon totes and tilt the tote when in service to drain entire contents. Polymer totes shall be positioned on tote truck using a fork-lift or overhead crane. Tote truck shall include two fixed wheels and two swivel wheels. Swivel wheels shall be lockable. The tote truck shall be constructed of powder coated steel and rated for #4000 pounds.

Part 3 **execution**

3.1 **SHOP TESTING**

.1 The polymer feed system shall be fully shop tested prior to shipment.

3.2 **SITE TESTING**

.1 The polymer feed system shall be subjected to a mechanical, electrical and pump delivery site test by a qualified technical representative of the pump manufacturer.

3.3 **MANUFACTURER'S FIELD SERVICES**

.1 Provide the services of a qualified field service technician to inspect and certify the installation, start-up the equipment, trouble shoot any problems that may arise and providing complete and thorough training of operator personnel.

.2 Field services shall consist of one (1) eight (8) hour day, exclusive of travel time.

.3 For commissioning and training, refer to Dewatering Centrifuge section 46 76 00, part 3.6.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 The supply and application of all factory applied prime coats or factory applied finish coats.

1.2 SUBMISSIONS

.1 With the equipment Shop Drawings, the Contractor shall submit details of the coating systems to be applied.

1.3 QUALITY ASSURANCE

.1 This specification is intended to be a minimum reference standard. The manufacturer may submit for review alternative coating systems for specific items of equipment which provide equal or better corrosion protection and maintenance service than those specified herein.

Part 2 Products

2.1 SURFACE PREPARATION

.1 Immersion Service: After degreasing, dry blast all ferrous components to a white metal finish in accordance with SSPC-SP5 to a degree of cleanliness in accordance with NACE #1 and obtain a 50-micron blast profile.

.2 Non-immersion Service: After degreasing, dry blast all ferrous components to a near white finish in accordance with SSPC-SP10 to a degree of cleanness in accordance with NACE #3 and obtain a 50-micron blast profile.

2.2 PRIME COATING

.1 Prime coat all ferrous surfaces before the blasted surfaces deteriorate.

.2 Coat ferrous surfaces with inorganic zinc primer, containing a minimum of 50 percent solids by volume, applied to a minimum dry film thickness of 75 microns.

2.3 FINISH COATS

.1 Apply finish coats in conformance with Section 46 90 00 – Field Applied Corrosion Protection and Maintenance Coatings for service, coating types and application rates.

2.4 ASSEMBLY

.1 Items which are to be bolted together before shipment shall have their surfaces cleaned and coated before the parts are assembled.

.2 Continuous weld all welded connections, sealing the mating surface completely. On completion of the welding and fettling, treat all weld seams with phosphoric acid solution. Rinsed and thoroughly dry before the prime is applied.

.3 Where dissimilar metals are mated such as aluminum and steel, insulate the mating surfaces from one another to provide protection against corrosion. Insulate bolts, nuts, washers and rivets in a similar manner.

.4 Use Type 304 stainless steel or better for all nuts, bolts, washers and similar fittings for immersion service. Nuts, bolts, washers, and similar fittings for non-immersion service shall be Type 304 stainless or zinc or cadmium plated. The inner face of non-threaded bolt holes are to be cleaned and coated as required for other surfaces.

Part 3 Execution

3.1 INSPECTION

.1 The manufacturer shall notify the Engineer two (2) weeks before commencing the protective coating in order to facilitate the inspection by the Engineer of the surface preparation and protective coating application.

3.2 PROTECTION

.1 Protect all coated equipment adequately against damage, dust, moisture and scratching during shipment, off-loading and storage on-site. If, in the opinion of the Engineer, the coating is damaged during shipment to the extent that touch up would not be satisfactory, the equipment shall be returned and re-coated at no added cost to the Owner.

.2 Damage to coatings occurring at any time shall be made good prior to the application of any further coatings.

3.3 APPLICATION Conditions

.1 Apply all factory applied coatings under controlled conditions. The atmosphere shall be dust free and kept at a temperature of between 10°C and 20°C. The relative humidity should not exceed 80 percent.

END OF SECTION

DISTRICT OF SOOKE

REQUEST FOR TENDER
TENDER 1790-20/2020-WWTP-001

SUPPLY AND DELIVERY OF SCREW CONVEYORS

DISTRICT OF SOOKE WWTP UPGRADES 2020

January 20th, 2020

The District of Sooke invites qualified Tenders for the supply, delivery, start-up and commissioning of new dewatered cake screw conveyors and related equipment for incorporation into the District of Sooke WWTP Upgrades 2020 in the District of Sooke, BC. The tender consists of the fabrication, delivery, start-up and commissioning of new dewatered cake screw conveyors and accessories as herein specified.

The Tender is available electronically by downloading from BC Bid's website.

A hard copy of the Tender Package is available for viewing, upon request, from 8:30 a.m. to 4:30 p.m., Monday to Friday at District of Sooke Municipal Hall, 2205 Otter Point Road, Sooke. Electronic copies are available on BC Bid.

Tenders are scheduled to close at:

Tender Closing Time:	**2:00 p.m. Local Time**
Tender Closing Date:	**Tuesday February 4, 2020** *There will be a Public Opening for this Tender*
Delivered to:	District of Sooke 2205 Otter Point Road Sooke, British Columbia V9Z 1J2 ATTN: Norm McInnis, Chief Administrative Officer
Tender Enquiries:	Shaun Swarbrick, P.Eng., Stantec Consulting Ltd. Telephone: 250.389.2545 Email: shaun.swarbrick@stantec.com Eric Millette, P.Eng., Stantec Consulting Ltd. Telephone: 250.389.3031 Email: eric.millette@stantec.com

DISTRICT OF SOOKE

RECEIPT CONFIRMATION FORM

REQUEST FOR TENDER
TENDER 1790-20/2020-WWTP-001

SUPPLY AND DELIVERY SCREW CONVEYORS

DISTRICT OF SOOKE WWTP UPGRADES 2020

As receipt of this document, ***and*** to directly receive any further information about this Request for Tender, please return this form to:

Attention: Norm McInnis
District of Sooke
2205 Otter Point Road
Sooke, BC V9Z 1J2
Fax: 250.382.0514
Email: NMcInnis@Sooke.ca

Company Name: _____

Address: _____

District: _____

Province/State: _____ Postal/Zip Code: _____

Telephone No: _____ Fax No: _____

Contact Person: _____

Title: _____

Email: _____

Part 1 **Invitation**

1.1 INVITATION TO TENDER

The District of Sooke (the "District") invites Tenders from qualified Tenderers for the supply, delivery, start-up and commissioning of a screw conveyors and related equipment.

1.2 SCOPE OF SUPPLY AND DESCRIPTION OF GOODS

.1 The supply, delivery, start-up and commissioning of screw conveyors for incorporation into the District of Sooke WWTP Upgrades 2020 in Sooke, BC. This consists of the following.

.1 Supply of three screw conveyors and associated equipment to convey dewatered sludge cake at the Sooke Wastewater Treatment Plant in Sooke, British Columbia.

.2 Installation support services.

.3 Testing, start-up and commissioning support services

.2 This tender consists of the supply, delivery, start-up and commissioning of the dewatered cake screw conveyors and related equipment, as detailed on the drawings and in the specifications (the "Goods").

.3 Delivery Point: Sooke Waste Treatment Facility; 7113 West Coast Road, Sooke, BC, V9Z 0S2.

1.3 TENDER SUBMISSION

.1 Tenders will be received at the specified physical location referred to below no later than ("Tender Closing"):

Norm McInnis, Chief Administrative Officer
District of Sooke
2205 Otter Point Road
Sooke, British Columbia
V9Z 1J2

Tender Closing Time: **2:00 p.m. local time**
Tender Closing Date: **Tuesday February 4th, 2020**
There will NOT be a public opening for this Request for Tender

.2 The Tenderer must submit to the District all the completed and executed documentation in a sealed envelope or package including all attachments and enclosures, on the exterior of which should be indicated the name of the Tenderer.

.3 The time of Tender Closing shall be established by the time shown on the clock for local area network at the closing location.

.4 Tenders received after the Tender Closing, Clause 1.3.1 will not be considered by the District and will be returned unopened to the Tenderer.

.5 No oral or electronically transmitted Tenders or amendments to Tenders will be considered.

.6 By submitting a Tender, the Tenderer agrees that it shall be solely responsible for any and all costs and expenses incurred by it in preparing and submitting its Tender, including any costs incurred by the Tenderer after the Tender Closing.

.7 Defined terms in the Tender Documents shall have the same meanings as set out in Clause 1.1 of the General Conditions Section 00 50 00, except where the contrary is expressed.

.8 Tenderers are requested to return the enclosed Receipt Confirmation Form within two working days of receipt.

Part 2 Tender Documents

2.1 An electronic version of the Tender Documents is available on BC Bid.

2.2 The District's language in its procurement documents shall be English.

Part 3 Tender Enquiries and Addenda

3.1 Enquiries should be addressed to the Contact Person: Stantec Consulting Ltd.
Shaun Swarbrick, P.Eng.
Telephone: 250.389.2545
Email: shaun.swarbrick@stantec.com

Eric Millette, P.Eng.
Telephone: 250.389.3031
Email: eric.millette@stantec.com

3.2 Any requests for explanations, interpretations or clarifications made by Tenderers should be submitted in writing to the individual named in Section 00 10 00, clause 1.3.1 at least three (3) business days before Tender Closing.

3.3 Explanations, interpretations, or clarifications may be made in the form of Addenda. All Addenda issued by the District shall be incorporated into and become part of the Tender Documents.

3.4 Addenda may be issued by the District before Tender Closing and will be distributed via e-mail by the contact person to all who have provided a completed Receipt Confirmation Form.

3.5 The Tenderer must carefully examine the Contract Documents and the site of the proposed works and the Delivery Point, judging for and satisfying themselves as to the probable conditions to be encountered. Should a Tenderer find omissions from or discrepancies in the Contract Documents, or be in doubt as their meaning, the Tenderer should notify the contact person no later than five (5) days prior to the tender closing, who may cause to send a written instruction to all Tenderers in the form of an addendum, which shall become part of the contract and shall be covered in the contract price. The Tenderer may not claim, after the submission of a tender, that there was any misunderstanding with respect to the conditions imposed by the documents.

3.6 No oral interpretations made to a Tenderer as to the meaning of the Contract Documents shall be considered binding. Every request for an interpretation shall be made in writing, forwarded to the Contact Person referred to in paragraph 3.1.

Part 4 Inspection of Delivery Point

4.1 The submission of a Tender by the Tenderer shall be deemed to be an acknowledgement that the Tenderer has relied and is relying on its own examination of the Delivery Point and all other matters related to the completion of delivery.

Part 5 Completion of Tender Documents

5.1 The Tenderer shall complete the Tender Form in ink or in type.

5.2 The quantities stated herein are estimates only and are given for the purpose of providing a uniform basis for the comparison of tenders. Payment will be based on actual quantities.

5.3 All prices are to be in Canadian currency, unless otherwise stated. Prices shall be shown for each unit specified and shall include all necessary costs including but not limited to supply, fabrication and finishing, conveyance and delivery, packing, crating, freight, cartage, shipping charges, drafting charges, overhead, profit and all tariffs, duties and taxes, including Provincial Sales Tax. The applicable Goods and Services Tax (GST) shall be shown as a separate item in the tender price.

Part 6 Solicitation

6.1 The Tenderer may not make any representations or solicitations to any council member, officer or employee of the District with respect to the Tender either before or after submission of the Tender except as provided herein. If any director, officer, employee, agent sub- contractor, supplier or other representative of the Tenderer communicates with any council member, officer or employee of the District or any consultant engaged by the District in connection with this Invitation to Tender about this Invitation to Tender, other than the Contact Person named under Part 3 – Pre-Tender Enquiries and Addenda, the District may, regardless of the nature of the communication, reject the Tender submitted by the Tenderer.

Part 7 Submission of Tenders

7.1 The Tenderer must submit the following completed and executed documentation:

.1 Tender Form Sections 00 20 00, 00 40 00;

.2 A security ("Bid Security") in the form of 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 in an amount equal to 10% of the Tender price;

.3 In a sealed envelope or package, on the exterior of which should be indicated the Tender Number and the name of the Tenderer.

.4 The Tender shall be submitted no later than the Tender Closing at the following specified physical location set out in Section 00 10 00 Clause 1.3.1.

7.2 No oral or electronically transmitted Tenders or amendments to Tenders will be considered.

7.3 It is solely the responsibility of the Tenderer to ensure that it has obtained, prior to the Tender Closing, all Addenda issued by the District.

7.4 The District will not accept an amendment to a previously submitted Tender unless:

.1 it is in writing;

.2 it is received at the specific physical location set out in Section 00 10 00, Clause 1.3.1, prior to the Tender Closing in a sealed envelope or package on the exterior of which should be indicated the Tender Number and the name of the Tenderer;

.3 it indicates a change to a Tender already submitted; and

.4 it is signed and the amendment indicates that the person who signed is an authorized signatory of the Tenderer.

7.5 It is solely the responsibility of the Tenderer to ensure that its Tender and any amendments are received at the specific physical location set out in Section 00 10 00, Clause 1.3.1.

7.6 Tenderers shall be solely responsible for the completion and delivery of Tenders and any amendments in the manner and time specified by Section 00 10 00, Part 7.

7.7 Tender form must be signed by an authorized signatory of the Tenderer.

7.8 Tenderer must acknowledge receipt of all Addenda.

Part 8 **Withdrawal of Tenders**

8.1 A Tenderer may withdraw its Tender after it has been submitted to the District, provided the request for withdrawal is made in writing, signed by an authorized signatory for the Tenderer, delivered (not mailed) to the office referred to in Section 00 10 00, Clause 1.3.1 and received by the District before the time set for the Tender closing .

Part 9 Irrevocability of Offer

9.1 The Tender submitted by the Tenderer shall be irrevocable and remain open for acceptance by the District for a period of 120 business days from the Tender Closing, whether another Tender has been accepted or not.

9.2 If a Tenderer, for any reason whatsoever, purports to revoke its Tender within 120 business days from the Tender Closing, or if for any reason whatsoever a successful Tenderer does not execute and deliver the Agreements in accordance with Section 00 10 00, Clauses 12.1 and 15.1, the District, without limiting any other remedy it may have under the Tender Documents or otherwise, shall be entitled to require the Tenderer to pay to the District an amount equal to the difference between the tender price of its Tender and any other Tender which is accepted by the District, if such other Tender is for a greater price, plus the total of all costs, expenses and damages, including legal fees on a solicitor and own client basis, incurred by the District as a result of or related to such revocation or failure by the Tenderer.

Part 10 Acceptance and Rejection of Tenders

10.1 Notwithstanding any other provision in the Tender Documents, any practice or custom in the industry, or the procedures and guidelines recommended for use on publicly funded projects, the District, in its sole discretion, shall have the unfettered right to:

.1 accept any Tender;

.2 reject any Tender;

.3 reject all Tenders;

.4 accept a Tender which is not the lowest Tender;

.5 reject a Tender even if it is the only Tender received by the District;

.6 accept all or any part of a Tender; and

.7 award all or a portion of the contract to supply the Goods to any Tenderer.

10.2 If a Tender contains a defect or fails in some way to comply with any of the requirements of the Tender Documents, including where such non-compliance is material, the District may, in the sole and unfettered discretion of the District, waive the defect or non-compliance and accept the Tender.

10.3 The District will notify the successful Tenderer in writing that its Tender has been accepted (the "Notice of Award") as well as notifying, in writing, the unsuccessful Tenderers.

10.4 Acceptance of any Tender may be subject to budgetary considerations and District of Sooke Council approval.

10.5 If the Form of Tender requires unit prices for optional items, the District may, in its sole discretion, compare Tenders with and without pricing for all or any such optional items and may accept a Tender with some, all or none of such optional items.

Part 11 Successful Tenderer Requirements

11.1 The successful Tenderer shall execute and deliver the Agreement in the form set out in Sections 00 40 00, in triplicate, to the District within ten (10) Days after it has received the Agreement from the District.

11.2 The successful Tenderer shall submit to the District the following original documentation within seven (7) Days of receiving the Notice of Award;

.1 An original certificate of insurance pursuant to Section 00 50 00, Clause 5.2, in a form acceptable to the District.

.2 Performance Bond in the amount of 50% of the Contract value.

.3 Confirmation of Shop Drawing submission date.

Part 12 Confidentiality and Security

12.1 The following conditions apply:

.1 The Tender Documents, or any portion thereof, may not be used for any purpose other than submission of Tenders; and

.2 If a Tenderer considers that any part of their Tender is confidential, they shall indicate this in their Tender. Tenderers should be aware, however, that pursuant to section 21 of the *Freedom of Information and Protection of Privacy Act*, the District may be required to disclose such information, even though it is expressed to be confidential, pursuant to a request for information made under that Act. Tenderers are advised to review that Act.

Part 13 Disclaimers/Limitations of Liability

13.1 The District, its council members, officers, servants, employees and agents expressly disclaim any duty of care and all liability for representations, warranties, express or implied or contained in, or for omissions from this Request for Tender or any written or oral information transmitted or made available at any time to a Tenderer by or on behalf of the District. Nothing in this Request for Tender is intended to relieve a Tenderer from forming its own opinions and conclusions in respect of this Request for Tender, and the Tenderer hereby waives for itself, its successors, heirs and executors, the right to sue the District in tort for any loss, including economic loss, damage, cost or expense arising from or connected with any error, omission or misrepresentation occurring in the preparation of Tender and the Contract Documents.

13.2 No Tenderer shall have any claim for any compensation of any kind whatsoever, as a result of participating in this Request for Tender, and by submitting a Tender each Tenderer shall be deemed to have agreed that it has no claim.

END OF SECTION

TENDER FORM

Contract: SUPPLY AND DELIVERY OF SCREW CONVEYORS

1. I (WE), THE UNDERSIGNED:

have received and carefully reviewed all of the Contract Documents, including the Instructions to Tenderers, and the following Addenda which form a part of this tender:

_____

_____

_____

(Addenda, if any) (Tenderer to Complete)

2. TENDER DOCUMENTS

2.1 The Tender Documents for this Contract include the following:

a. All documents listed in Section 00 10 00, Table of Contents;

b. Drawings: Issued for Equipment Pre-purchase

c. Addenda as issued.

3. TENDERERS OFFER

3.1 The Tenderer hereby offers to perform and complete all of the Work and to supply all the plant, material, equipment, labour and workmanship, and to do everything further necessary, as set out in the Contract Documents for the fulfillment of **TENDER** for the **SUPPLY AND DELIVERY OF SCREW CONVEYORS** to the **DISTRICT OF SOOKE** on the terms and conditions therein contained and within the time specified limited and for the amounts set out in the completed schedule of unit prices (Schedule 1 - Quantities and Prices).

4. TENDERERS DECLARATIONS

4.1 The Tenderer declares that it has read and understood and agrees to be bound by the Tender Documents.

4.2 Without limiting the generality of Section 00 20 00, Clause 4.1, the Tenderer declares that it has fulfilled and complied with all of those obligations and requirements under the Tender Documents which are required to be fulfilled by the Tender Closing.

4.3 The Tenderer confirms, represents and warrants that all information which it has provided to the District is true and accurate in every respect.

5. SCHEDULES

5.1 The immediately following Schedules, namely:

Schedule 1 - Quantities and Prices
Schedule 2 - Supply and Delivery Dates

shall form part of the Tender Documents. The Tenderer shall complete the Schedules and submit per Section 00 10 00, Clause 7.1.

5.2 The information contained in the Schedules may be used by the District to assess the Tenderers ability to perform the Contract and may be taken into account by the District in its decision to award the Contract.

5.3 All prices shall be shown in Canadian currency.

END OF SECTION

SCHEDULE 1 – QUANTITIES AND PRICES

The Tenderer hereby submits unit prices as required by the specifications and agrees that these prices will be used for payment for the Goods including Goods additional to and deleted from the Contract and agrees that the prices quoted shall remain in force until the date of completion of the Contract.

The Tenderer confirms that the tender price, including any unit prices, include all necessary costs including but not limited to supply, fabrication and finishing, conveyance and delivery to the Delivery Point, packing, crating, freight, cartage, shipping charges, drafting charges, overhead, profit and all tariffs, customs, duties and taxes, including provincial sales tax, with the exception of GST which shall be shown separately.

The total of the unit prices plus the applicable GST shall agree with the total tender price.

SCHEDULE 1 – QUANTITIES AND PRICES

Item	Description	Qty	Unit	Unit Price ($)	Total Price ($)
1	Supply and delivery of new screw conveyor No. 1 and **ALL ASSOCIATED EQUIPMENT** summarized in Section 41 12 00 as part of this Tender package.	1	LS	$	$
2	Supply and delivery of new screw conveyor No. 2 **ONLY** summarized in Section 41 12 00 as part of this Tender package.	1	LS	$	$
3	Supply and delivery of new screw conveyor No. 3 **ONLY** summarized in Section 41 12 00 as part of this Tender package.	1	LS	$	$
	Supply and delivery of electrical and instrumentation equipment (if required)	1	LS	$	$
4	Shop drawing submittal Not to exceed 10% of items 1 to 3	1	LS	$	$
5	Startup, commissioning and training of supplied equipment. Assume 5 days/ 1 trip Not to exceed 10% of items 1 to 3	1	LS	$	$
6	Optional(1): Retrofit of existing conveyor in lieu of screw conveyor No. 2.	1	LS	$	$
				GST (5%) of total	$
				Total	$

(1) This item is all costs associated with retrofitting of the existing screw conveyor from the existing centrifuge to match charateriatics of screw conveyor No. 2.

(2) Electrical and instrumentation equipment must be provided if required to meet specifications.

The tender price stated above will be used to compare submitted Tenders. The District reserves the right to check the above extensions and additions and to make corrections as necessary.

The unit prices will govern payments for the Goods of the resulting Contract.

PAYMENT TERMS

Refer to Section 01 27 00 Measurement and Payment, Clause 1.4 Progress Payments, for a description on how payments will be made.

SCHEDULE 2 – SUPPLY AND DELIVERY DATES

1. The Tenderer shall complete the following Schedule of Supply and Delivery Dates for the Goods and shall be prepared to supply the Goods to the Delivery Point no later than the date shown on Table 1 below. The Schedule of Supply and Delivery should be the Tenderers best realistic delivery date.

2. It is the intent of the Contract that the Goods, including all main equipment, ancillaries, accessories and any tools, be supplied as completely assembled as practical. If it is the intent of the Tenderer to supply any Goods, accessories and tools in components or not completely assembled, the Tenderer should indicate the separate components or provide a description of the state of assembly for each type of equipment.

3. Final schedule is ultimately determined by the General Contractor responsible for delivering the construction contract; however, Supply Contractor shall be prepared to deliver materials as required to site by the date indicated in Table 1 below.

4. The project intent is to have the construction completed by the end of August 31st, 2020.

5. Table 1 – Supply and Delivery Dates

   In response to the District's preferred delivery dates, the Tenderer offers its best delivery schedule as follows:

TABLE 1 – SUPPLY AND DELIVERY DATES

Item	**Description**	**Tender's Proposed Delivery Date**	**The District's Preferred Delivery Date Schedule**
1	Complete Shop Drawings Weeks following Notice to Proceed		2 weeks
2	Equipment Delivered to Site Weeks following completion of Shop Drawing Review		10 weeks

DRAFT CONTRACT AGREEMENT

THIS AGREEMENT made this_____day of_____, 2020.

BETWEEN: _____(the "Supply Contractor")

AND: District of Sooke (the "District")

THIS AGREEMENT WITNESSES that the Supply Contractor and the District agree as follows:

1. The Supply Contractor shall provide all labour, materials, equipment, supplies and all other items required to supply the Goods and perform all other Work within the required time, as required by the Contract Documents.

2. The District shall pay the Supply Contractor the Contract Price, as required by the Contract Documents.

3. The Contract Price shall be the sum in Canadian Dollars of the following:

   .1 the tender price, as set out Section 00 20 00, and

   .2 any payments made on account of changes, as may be required by the Contract Documents.

   The Contract Price shall be the entire compensation payable to the Supply Contractor by the District for the Goods other Work and shall cover and include necessary costs including but not limited to all supervision, labour, materials, equipment, supplies and all other items, overhead, profit, financing costs, duty, shipping charges, fabrication and finishing, storage as required, conveyance and delivery, packing, crating, freight, cartage, drafting charges, tariffs, warranty and all other costs and expenses whatsoever incurred in performing the Contract.

4. The Supply Contractor shall supply all Goods to the Delivery Point no later than the dates shown on Section 00 20 00 Schedule 2, including revisions under Section 00 50 00, Item 7.1.2, if any.

5. The Contract Documents shall form a part of this Agreement.

6. The Contract supersedes all prior negotiations, representations or agreements, whether written or oral and is the entire agreement between the District and the Supply Contractor with respect to the subject matter of this Agreement.

Capitalized terms in this Agreement shall have the meanings as set out in Section 00 50 00, Clause 1.1.

7. The Supply Contractor shall not assign the Contract, or any portion of the Contract, or any payments due or to become due under the Contract, without the express written consent of the District.

8. No action or failure to act by the District or an authorized representative of the District shall constitute a waiver of any right or duty afforded any of them under the Contract or constitute an approval or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

9. This Agreement shall ensure to the benefit of and be binding upon the District and the Supply Contractor and their respective heirs, executors, legal representatives, successors and permitted assigns. In the event of more than one person being the Supply Contractor, such persons shall be jointly and severally liable for all of the representations, warranties, covenants and obligations of the Supply Contractor under the Contract.

10. Time shall be of the essence of this Agreement.

11. This Agreement is governed by the laws of British Columbia, Canada.

IN WITNESS WHEREOF the parties hereto have executed this Agreement as follows:

DISTRICT OF SOOKE

by its authorized signatory on_____day of_____, 2020:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[SUPPLY CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2020:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

Part 1 **General**

1.1 **DEFINITIONS**

.1 The following words and terms, unless the context otherwise requires, in all Contract Documents, shall have the meanings set out below.

"Addenda" means any and all addenda issued by the District;

"Agreement" means the agreement set out in Section 00 40 00;

"Construction Contract" means the agreement between the District and the General Contractor who is to install the Goods supplied pursuant to the Contract;

"Contract" means the agreement formed by the District's acceptance of the Tender for completion of the work set out in the Contract Documents;

"Contract Documents" means the following documents:

.1 the Tender Documents
.2 the executed Tender Form
.3 the executed Bonds, if any,
.4 the executed Agreement
.5 the General Conditions
.6 Drawings, if any
.7 Specifications
.8 Change orders
.9 Addenda
.10 other relevant documents such as but not limited to letters of clarification and any reports, standards or the like included by reference;

"Contract Price" has the meaning set out in Section 00 40 00 Clause 3;

"Day" means calendar day;

“Delivery Date” has the meaning set out in Section 00 20 00 Schedule 2;

“Delivery Point” means the location set out in Section 00 10 00 Clause 1.2.3;

"Drawings" means the drawings included in the Tender Documents together with those prepared by the District and the General Contractor and the Supply Contractor pursuant to the terms of the Contract and include:

.1 Modifications of drawings issued by Addenda;

.2 Drawings submitted by the General Contractor or Supply Contractor during the progress of the work and accepted by the District either as attachments to change orders or as non- modifying supplements to the drawings in the Tender Documents including drawings issued by Addenda;

.3 Drawings submitted by the District to the General Contractor or Supply Contractor during the progress of the work either as attachments to change orders or as explanatory supplements to the drawings in the Tender Documents including drawings issued by Addenda;

"Engineer" means the Engineer of the District and any person duly authorized to act as Engineer on behalf of the District;

"General Contractor" means the person, who or which is to install the Goods supplied pursuant to the Contract;

"Goods" means the goods set out in Section 00 10 00 Clause 1.2.1 and comprising the subject matter of this Contract;

"Notice of Award" has the meaning set out in Section 00 10 00 Clause 11.4;

"Specifications" means that part of the Contract Documents consisting of general requirements and written descriptions of the technical features of materials, equipment, construction systems, standards and workmanship;

"Submittals" means the information which has to be submitted to the District in accordance with Section 01 33 00;

"Supply Contractor" means the person who or which executes the Agreement;

"Tenderer" means a person submits a Tender;

"Tender" means a Tenderer's offer set out in Section 00 20 00 and includes the Tender Documents;

"Tender Closing" has the meaning set out in Section 00 10 00 Clause 1.3.1;

"Tender Documents" means the documents, drawings and addenda set out in Section 00 20 00 Clause 2.1;

"District" has the meaning set out in Section 00 10 00 Clause 1.1

"WHMIS" means Workplace Hazardous Materials Information System.

"Work" means anything and everything required to be done for the fulfilment and completion of this agreement.

1.2 PARTNERSHIPS & JOINT VENTURES

.1 If the Supply Contractor is a partnership or joint venture the individual partners or joint venturers shall be jointly and severally liable for all of the Supply Contractor's representations, warranties, covenants and obligations under the Contract.

1.3 CONTRACT REQUIREMENTS

.1 Successors' Obligations

.1 The Contract shall enure to the benefit of and be binding upon not only the parties hereto but also their respective successors and permitted assigns.

.2 Assignment of Contract

.1 The Supply Contractor shall not assign the Contract in whole or in part, nor any payments due or to become due under the Contract without the prior written consent of the District. No assignment of the Contract shall relieve the Supply Contractor from any obligation under the Contract or impose any liability on the District. Involuntary assignment of the Contract as a result of, inter alia, bankruptcy, assignment of the Contract for the benefit of creditors or appointment of a receiver, or insolvency shall be deemed default under the Contract entitling the District to terminate the Contract as hereinafter provided.

.3 Waiver of Rights

.1 Except as herein provided, no act or failure to act by the Supply Contractor, the District, or the Engineer at any time with respect to the exercise of any right or remedies conferred upon them under this Contract shall be deemed to be a waiver on the part of the Supply Contractor, the District or the Engineer, as the case may be, of any of their rights or remedies. No waiver shall be effective except in writing. No waiver of one right or remedy shall act as a waiver of any other right or remedy or as a subsequent waiver of the same right or remedy.

.4 Amendment of Contract Documents

.1 The Contract Documents shall not be amended except as specifically agreed in writing signed by both the District and the Supply Contractor.

1.4 LAWS, REGULATIONS AND PERMITS

.1 The Contract shall be construed under and according to the laws of the Province of

.1 British Columbia and subject to an agreement to refer a dispute to arbitration under Section 00 50 00, Clause 2.4.7, the parties agree to irrevocably attorn to the jurisdiction of the Courts of the Province of British Columbia.

.2 The Supply Contractor shall give all notices required by law and shall comply with all laws, acts, ordinances, rules and regulations relating to or affecting the Goods. If any permits, authorizations, approvals or licences from any government or governmental agencies are necessary or desirable for the prosecution of the Work they shall be obtained by the Supply Contractor at its expense, provided that the Supply Contractor shall not make application for any such permit, authorization, approval or licence without first obtaining the written consent of the District.

.3 Patents, Royalties and Copyright

.1 The Supply Contractor shall pay all fees, royalties or claims for any patented invention, article, process or method that may be used upon or in a manner connected with the Goods or with the use of the Goods by the District. Before final payment is made on the account of this Contract, the Supply Contractor shall, if

requested by the District, furnish acceptable proof of a proper release from all such fees or claims.

.2 If the Supply Contractor, its agent, employee or any of them is prevented from furnishing or using any invention, article, material or Drawings supplied or required to be supplied or used under this Contract, the Supply Contractor either shall promptly pay such royalties and secure the requisite licences or, subject to written approval by the District, substitute other articles, materials or appliances in lieu thereof which are of equal efficiency, quality, finish, suitability and market value to those planned or required under the Contract.

.3 The Supply Contractor shall submit to the Engineer descriptive information of these proposed substitutions. Approval by the District of any substitutions shall not relieve the Supply Contractor of its responsibility if the substitutions do not function as well as the original specified in the Contract and shall not be deemed an assumption of risk or responsibility by the District. Approval shall only mean the District has no objection to the substitution being utilized at the Supply Contractor's risk. If the District refuses to approve the substitution, the Supply Contractor shall pay such royalties and secure such valid licences as may be requisite for the District, its directors, officers, agents and employees or any of them, to use such invention, article, material or appliance without being disturbed or in any way interfered with by any proceeding in law or equity on account thereof.

.4 All references to money in the Contract Documents shall be interpreted as meaning lawful currency of Canada.

1.5 HEADINGS

.1 Headings to parts, divisions, sections, clauses and forms are inserted for convenience of reference only and shall not affect the interpretation of the Contract Documents.

Part 2 District-Supply Contractor Relations

2.1 AUTHORITY OF DISTRICT

.1 Acceptability of Goods

.1 The District shall make the final determination of the acceptability of the Goods.

.2 Authority of Engineer

.1 The Engineer shall represent the District at the Delivery Point. The Engineer shall have the authority set out in the Contract Documents and such other authority as may be delegated in writing by the District including but not limited to the following:

.1 to make decisions regarding the Goods;

.2 to make decisions regarding the manner of performance and rate of progress of supply of the Goods;

.3 to make decisions regarding clarifications and interpretation of the Contract Documents.

The District may appoint a new Engineer from time to time by providing notice of such appointment to the Supply Contractor

2.2 RESPONSIBILITIES OF THE SUPPLY CONTRACTOR

.1 Attention to the Goods

.1 The Supply Contractor shall diligently attend to the supply of the Goods so that they are delivered faithfully, expeditiously and in accordance with the Contract Documents.

.2 Authorized Representative

.1 The Supply Contractor shall advise the Engineer in writing of the name of the Supply Contractor's authorized representative.

.3 Off-loading of Goods

.1 The Supply Contractor shall provide all necessary instruction and Delivery Point personnel to ensure satisfactory off-loading, storage, and testing of the Goods.

.4 Shipment

.1 The Supply Contractor shall properly package all Goods for safe shipment to the Delivery Point and a Notice of Shipment shall be sent by the Supply Contractor to the District at least 2 weeks before the Goods are shipped. The Notice of Shipment shall state the number of the order, the kind of goods, the Supply Contractor's name and the carrier and route by which the shipment is being made.

.2 The Notice of Shipment shall indicate appropriate instructions, considerations or other information regarding the proper storage, handling, transfer, off-loading and installation of the Goods.

.5 Acceptable Delivery

.1 The Supply Contractor will arrange to have the Goods delivered to the Delivery Point between 8:00 a.m. and 3:30 p.m. Monday to Friday, statutory holidays excepted. The District shall not be responsible for Goods delivered outside the acceptable time for delivery.

.6 Transportation Costs

.1 If the Contract calls for payment of any transportation cost by the District, the District shall in no event be liable or accountable in excess of the actual costs of transportation.

.2 Supply Contractor shall be accountable for and pay any excess transportation costs arising from Supply Contractor's failure to make delivery to the Delivery Point or to follow shipping instructions furnished by the District.

.7 Employee Safety

.1 The Supply Contractor alone shall at all times be responsible for the safety of its employees, its subcontractors' employees and other persons and equipment lawfully at the Delivery Point in connection with the supply of Goods and shall comply with the standards for the Work Site, the Workers' Compensation Act and regulations thereto and under statutory and common law.

.2 The Supply Contractor shall cooperate with the directions of the General Contractor who will be designated as prime contractor for purposes of the Workers Compensation Act.

.8 Confidentiality

.1 The Supply Contractor shall agree not to divulge or release any information that has been given to it or acquired by it on a confidential basis during the course of providing the Goods.

2.3 DISTRICT - SUPPLY CONTRACTOR CO-ORDINATION

.1 Notice

.1 Any notice, order, directive, request or other communication (the "notice") given by the District or the Engineer to the Supply Contractor shall be deemed to be given to the Supply Contractor if left at any office used by the Supply Contractor or delivered to any of its officers or employees or posted at the Delivery Point or mailed by mail addressed to the Supply Contractor at the address given in the Contract Documents or mailed to the Supply Contractor's last known place of business. Any notice given to a Supply Contractor that is a joint venture or partnership shall be deemed to be given if delivered or mailed to any one of the joint ventures or partners or any of their officers or employees. Any notice to be given by the Supply Contractor to the District shall be deemed to have been given if sent by mail or delivered to the District at the address of the District set out in Section 00 10 00 Clause 1.3.1. Any notice sent by mail shall be deemed to have been given five (5) Days after the day of mailing.

.2 Co-operation and Entry on Delivery Point

.1 At the time of Delivery, it is intended that the Delivery Point will be under the control of the General Contractor responsible for the delivery of the construction contract, as the Prime Contractor as debard by WorkSafe BC Regulations. The Supply Contractor is to coordinate all actions while on the site with the General Contractor.

.3 The Engineer, if requested by the District or the Supply Contractor or any other contractor, shall consider any differences, conflicts or disputes between the Supply Contractor and any other contractor with regard to the Goods on or near the Delivery Point. The Engineer shall give such directions as it considers desirable to resolve such difference, conflict or dispute and its directions shall be binding on the Supply Contractor and insofar as it may have the authority, on any other contractor.

2.4 DISPUTE RESOLUTION

.1 Disputes

.1 A dispute occurs between the District and the Supply Contractor where there is a difference between the parties as to the interpretation, application or administration of the Contract.

.2 Determination by Engineer

.1 Except as otherwise specifically provided, questions regarding interpretation, application or administration of the Contract shall be referred by the Supply Contractor in writing to the Engineer for its decision. The Engineer shall review the matter and respond to the Supply Contractor in writing with the Engineer's decision within 21 Days after receipt of written notice from the Supply Contractor.

.3 Dispute of Decision

.1 If the Supply Contractor disputes a decision or instruction of the District or the Engineer (the "Disputed Decision"), the Supply Contractor shall give a detailed written notice of the dispute to the District within 21 Days of the date that the Supply Contractor received the Disputed Decision. The written notice must set out the nature of the dispute, the circumstances which gave rise to the dispute, the date on which these circumstances arose and the estimated cost of the work.

.2 The Supply Contractor shall be conclusively deemed to have accepted a decision or instruction of the District or the Engineer if the Supply Contractor does not dispute the Disputed Decision by giving the required written notice within the required time .

.4 No Engineer's Review

.1 Notwithstanding Section 00 50 00, Clause 2.4.3, if the Disputed Decision was made by the District pursuant to Section 00 50 00, Part 7, the Engineer shall not review the decision and the matter shall be dealt with as provided under Section 00 50 00, Clause 2.4.7.

.5 Instructions Pending Resolution

.1 If the Disputed Decision is not resolved promptly, the Engineer shall give any instructions as may be necessary for the supply of the Goods and to prevent delay in delivery of the Goods pending resolution of the dispute. The Supply Contractor shall comply immediately with the Engineer's instructions. If it is subsequently determined that the instructions were contrary to the Contract Documents, the District shall pay the costs incurred by the Supply Contractor in carrying out those instructions beyond what the Contract Documents required.

.6 Notice of Claim

.1 No payment shall be made by the District to the Supply Contractor in addition to the Contract Price on account of any extra expense, loss or damage incurred by or sustained by the Supply Contractor for any reason unless the Supply Contractor has given written notice of a claim to the District within 30 Days of the date the Supply Contractor first became aware of the circumstances which gave rise to the claim. The written notice must set out the date on which these circumstances arose and the estimated amount of the claim.

.2 The Supply Contractor shall be conclusively deemed to have waived any right to make a claim for any amount in addition to the Contract Price, if the Supply Contractor does not give the required written notice within the required time and provide the required information.

.7 Dispute/Claim Resolution

.1 All claims, disputes or Disputed Decisions between the District and the Supply Contractor that are not resolved shall be decided by arbitration if the parties agree, or failing agreement, in a Court of competent jurisdiction within the Province of British Columbia.

.2 In the event that the parties agree to arbitration, pursuant to Section 00 50 00, Clause 2.4.7.1, the arbitration shall be governed by the rules of the British Columbia International Commercial Arbitration Centre, except that the arbitrator or arbitrators shall be agreed upon by the parties, and failing agreement by the parties, shall be appointed by a Court of competent jurisdiction within the Province of British Columbia.

.3 In the event that the parties agree to arbitration, the arbitration shall take place in Victoria, British Columbia and be governed by the laws of British Columbia.

Part 3 Specifications and Drawings

3.1 INTERPRETATION OF SPECIFICATIONS AND DRAWINGS

.1 General

.1 The Specifications and Drawings are intended to be explanatory of each other. Goods specified on the Drawings and not in the Specifications, or vice versa, shall be executed as if specified in both.

.2 Request for Clarification

.1 If the Supply Contractor requires any clarification concerning the Specifications or Drawings, it shall direct its request in writing for clarification to the District. The District may issue a letter of clarification to the Supply Contractor if the District considers it necessary to do so.

3.2 CONFLICTING PROVISIONS, ERRORS AND OMISSIONS IN CONTRACT DOCUMENTS

.1 Conflicting Provisions

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

.1 the Agreement: Section 00 40 00
.2 the letters of clarification, if any
.3 the most recent Addendum
.4 other Addenda, the more recent taking precedence over earlier Addendaey
.5 the General Conditions
.6 the Notice of Award and/or Purchase Order
.7 the Tender
.8 the Specifications
.9 the Drawings
.10 the Invitation to Tender
.11 other Contract Documents.

.2 Errors and Omissions

.1 If the Supply Contractor discovers that there are any errors or omissions in the Contract Documents, it shall immediately notify the District in writing. The District will review the matter and if it concludes that there is an error or omission, it shall determine the corrective actions to be taken and will advise the Supply Contractor accordingly. If the corrective work associated with an error or omission increases or decreases the amount of work called for in the Contract, the District shall issue an appropriate change order. After discovery by the Supply Contractor

of an error or omission in the Contract Documents any work thereafter performed by the Supply Contractor shall be done at its risk unless otherwise agreed by the District.

.3 Figured dimensions on a drawing take precedence over measurements scaled from the drawing, and large-scale drawings take precedence over those of a smaller scale. Supplementary drawings and specifications supersede their antecedents. In case of conflict between figured dimensions on a drawing and the dimensions of a specified product, the dimensions of the specified product will govern.

Part 4 Material, Equipment and Workmanship

4.1 GENERAL

.1 The Goods shall be new and of the quality specified. All work related to the Contract Documents shall be done with new materials, articles, equipment and workmanship of the best quality and description and by employment of properly skilled workers and in strict conformity with and as required by the Contract Documents. Materials and equipment shall be the product of suppliers or manufacturers of established good reputation, regularly engaged in the supply or manufacture of such materials or equipment.

4.2 DEMONSTRATION OF COMPLIANCE WITH CONTRACT REQUIREMENTS

.1 Inspection

.1 The District or the Engineer or any inspector or agent appointed by either of them shall have access to the Goods and to the places the Goods are being manufactured, assembled, fabricated, stored or transported or where materials, equipment and machinery are being obtained for the Goods. The Supply Contractor at the Supply Contractor's sole cost shall provide to the Engineer or the District the assistance necessary for obtaining such access and shall provide all information necessary or desirable in connection with the inspection of the Goods.

.2 The Supply Contractor shall at all times give and cause to be given to the District or the Engineer or any inspector or agent appointed by either of them, free access to inspect and test the Goods, wherever same is being performed or carried out.

.3 Such inspections and testing shall not in any way relieve the Supply Contractor from any of its obligations or responsibilities under the Contract Documents, and shall not in any way prejudice or constitute a waiver of any rights or remedies of the District or any guarantees, warranties or covenants in favour of the District, and the District shall be entitled to rely on the expertise and obligations of the Supply Contractor and its subcontractors and their consultants and engineers to the same extent as if such inspections and testing by the District or the Engineer or any inspector or agent had not taken place.

.4 If the Contract Documents, laws, ordinances, or any public regulatory authority require parts of the Goods to be specially inspected, tested or approved, the Supply Contractor agrees that the Goods shall comply.

.5 The Goods are subject to inspection and acceptance by the Engineer within a reasonable time after receipt. The Engineer will notify the Supply Contractor in writing of the rejection of any of the Goods which are not in accordance with the Contract Documents, and the Goods will be held subject to disposition by the

Supply Contractor at the Supply Contractor's risk and subject to all charges accruing as a result of such rejection.

.6 Notwithstanding any prior payment therefore, all Goods are subject to inspection and testing by the District at the Delivery Point and if the Goods are to be incorporated into an operating facility, the District's inspection and testing of the Goods may be made under operating conditions after the Goods have been installed.

.2 Certification

.1 Where compliance of Goods, materials or equipment with the Contract Documents is not readily determinable through inspection and tests, the Engineer may require that the Supply Contractor provide, at the Supply Contractor's expense, properly authenticated documents, certificates or other satisfactory proof of compliance. These documents, certificates or other proof shall include performance characteristics, materials of construction and the physical or chemical characteristics of materials.

.3 Expenses

.1 Unless otherwise specified in the Contract Documents, the Engineer's travel, subsistence and labour expenses for inspection and testing shall be paid by the District. If the Supply Contractor requests the Engineer to inspect and test the Goods, materials or equipment at the point of manufacture, then the additional costs to the District for travel, subsistence and labour expenses shall be paid by the Supply Contractor and may be deducted by the District from any payment due to the Supply Contractor under the Contract. After an inspection by the Engineer, if the Goods, materials or equipment require further inspection by the Engineer, then the additional costs to the District for travel, subsistence, and labour expenses shall be paid by the Supply Contractor and may be deducted from any payment due to the Supply Contractor under the Contract.

4.3 DEFECTIVE OR IMPROPER GOODS

.1 Correction of Defective Goods

.1 If upon inspection, testing or otherwise the Goods or any portion thereof are found to be non-conforming, unsatisfactory, defective, or of inferior quality or workmanship, or fail to meet any guarantee of operating or other specifications contained herein, or any other requirements of the Contract Documents, then without prejudice to any other rights or remedies, the Engineer may give notice of its dissatisfaction to the Supply Contractor either verbally or in writing and the Supply Contractor shall immediately upon receipt of such notice do all things that are required to satisfy the Engineer. Any such verbal notice may be confirmed in writing by the Engineer if requested by the Supply Contractor within one working day of the verbal notice. If the Supply Contractor refuses or neglects to do all things that are required to satisfy the Engineer within one week from the receipt of notice, the District may employ some other person to do so and all expenses and costs consequent thereon or incidental thereto shall be charged to the Supply Contractor. The employment of such other person or the doing of the said work by the District itself shall not affect the Supply Contractor's duties and liabilities hereunder or relieve the Supply Contractor from the performance and fulfilment of any or all of

the Supply Contractor's warranties, covenants, undertakings, obligations and duties under the Contract.

.2 If upon inspection, testing or otherwise the Goods or any portion thereof are found to be non-conforming, unsatisfactory, defective, or of inferior quality or workmanship, or fail to meet any guarantee of operating or other specifications contained herein, or any other requirements of the Contract Documents, then without prejudice to any other rights or remedies, the District may return the Goods or any part thereof to the Supply Contractor at the Supply Contractor's sole cost and all amounts theretofore paid by the District to the Supply Contractor on account of the Contract Price of such returned Goods, shall be repaid to the District by the Supply Contractor. The Supply Contractor shall advise the District in writing, where to return the Goods, and failing such advice from the Supply Contractor, the Supply Contractor agrees to accept the returned Goods at the Supply Contractor's registered office. Neither the inspection nor failure to make inspection, nor acceptance of Goods shall release the Supply Contractor from any warranties or other provisions of this Contract nor impair the District's right to reject non-conforming Goods. The District reserves the right even after it has paid for and accepted Goods to make a claim against the Supply Contractor on account of any Goods which do not prove to be satisfactory or are defective irrespective of the District's failure to notify the Supply Contractor of a rejection of non- conforming Goods or revocation of acceptance thereof, or to specify with particularity any defect in non-conforming Goods after rejection or acceptance thereof.

.3 Retention of Defective Goods

.1 If in the opinion of the Engineer any portion of the Goods supplied under the Contract is defective or not in accordance with the Contract Documents and if the defect or imperfection in the same is not of sufficient magnitude or importance to make the Goods dangerous or undesirable, or if the removal of such Goods is impracticable, or will create conditions which are dangerous or undesirable, the District shall have the right and authority to retain such Goods instead of requiring the defective or imperfect Goods to be removed and reconstructed, but the District shall be entitled to make such deductions from the payments due or to become due to the Supply Contractor as are just and reasonable.

.4 No Implied Approval

.1 The fact that the Engineer or the District has not disapproved of or rejected any part of the Goods shall not be deemed or be construed to be an acceptance of any such part of the Goods or any such materials.

4.4 WARRANTY AND GUARANTEE

.1 The Supply Contractor agrees that the Goods Manufacturer's standard warranty will be to the benefit of the District and warrants that the Goods are free from all defects arising from faulty construction, manufacturing, materials, equipment or workmanship for the period of the Goods manufacturer's standard warranty period.

.2 The Supply Contractor warrants and guarantees that the Goods are free from all defects arising from faulty construction, manufacturing, assembly, materials, equipment or workmanship in any part of the Goods for a period of 12 months commencing from Screw Conveyor start-up and commissioning sign-off by the District. During the warranty period, the Supply Contractor, upon the receipt of notice in writing from the District or the Engineer, shall promptly make all repairs arising out of the defects referred to in this Clause

4.4.2. The District shall be entitled to make such repairs, if 10 Days after the giving of such notice to the Supply Contractor, the Supply Contractor has failed to make or undertake with due diligence the repairs. In case of an emergency, where, in the opinion of the District or the Engineer, delay could cause serious loss or damage, or inconvenience to the public, repairs may be made without notice being sent to the Supply Contractor, only after all reasonable attempts have been made to contact the Supply Contractor. The costs of any repair made by the District in connection with this Clause 4.4.2 shall be charged to the Supply Contractor and the Supply Contractor shall reimburse the District for such costs. All covenants and agreements shall continue to be binding on the Supply Contractor until they have been fulfilled.

.3 The District is relying on Supply Contractor's skill and judgment in selecting and providing the proper Goods and any applicable services for the District's particular use. The Supply Contractor warrants to the District and its successors in interest that the Goods and any services covered hereby will correspond with the description of the same in the Contract Documents, will conform to all applicable Specifications, will be new and of the best quality and, unless otherwise specified, will be fit for the purpose for which they are to be used and will conform in all aspects, both in the manufacture and use thereof, with all applicable safety orders or regulations of the Province of British Columbia. The Supply Contractor also warrants that the Goods are free and clear of all liens and encumbrances whatsoever and that the Supply Contractor has a good and marketable title to the same.

.4 The Supply Contractor warrants and guarantees that the Goods are free from all defects arising at any time from faulty design in any part of the Goods.

Part 5 Indemnification and Insurance

5.1 INDEMNIFICATION AND RELEASE

.1 The Supply Contractor shall save harmless and indemnify the District and its council members, officers, servants, employees and agents (the “Indemnified Parties”) from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature (including but not limiting the generality of the foregoing, in respect of death, injury, loss or damage to any person or property) arising in any way out of or connected with the Goods or the supply, or delivery of the Goods or performance of the Work under this Agreement, except to the extent that such actions, claims, demands, proceedings, suits, losses, damages, costs and expenses were caused by the Indemnified Parties or any of them.

.2 Unless otherwise specified in the Contract, the Supply Contractor shall save harmless and indemnify the Indemnified Parties from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature arising in any way from liability of any nature or kind for or on account of any copyrighted or uncopyrighted composition, secret or other process, patented or unpatented invention, articles or appliances manufactured, supplied or used in the Goods, and/or used or to be used by the District before or after supply of the Goods as a result of work performed by the Supply Contractor, and if the Supply Contractor shall fail to save harmless and indemnify in manner aforesaid, any money collected from the Indemnified Parties shall be charged to the Supply Contractor.

.3 The indemnity provided in this Clause 5.1 by the Supply Contractor to the Indemnified Parties shall not in any way be limited or restricted by any insurance or by limitations on

the amount or type of damages, compensation or benefits payable under the Workers' Compensation Act or any other similar statute.

5.2 INSURANCE

.1 General

.1 The Supply Contractor shall itself obtain and maintain, at its own expense, the insurance set out below until all conditions of the Contract have been fully complied with.

.2 Commercial General Liability Insurance

.1 Commercial General Liability Insurance providing third party bodily injury and property damage coverage in an amount of not less than $5,000,000 per occurrence, indicating that the District are additional insured and containing a cross liability and/or severability of interest clause protecting each insured to the same extent as if they were separately insured.

.2 The Policy shall contain a clause providing that the District will receive 30 Days notice of cancellation or of any material change in coverage which will reduce the extent of coverage provided to the District. The certificate will also indicate that the policy contains non-owned automobile liability and contractual liability coverage. The insurance policy will be in a form and with a company which are, in all respects, acceptable to the District.

.3 Evidence of Coverage

.1 The Supply Contractor shall file with the District prior to the commencement of work a certificate of insurance covering all policies and endorsements. The Supply Contractor shall also file with the District evidence of the renewal of each policy at least fifteen (15) Days prior to the expiry date of the policy.

.4 Indemnity Not Restricted by Insurance

.1 The provisions for insurance shown above shall not in any way limit the indemnity granted by the Supply Contractor to the Indemnified Parties elsewhere in this section.

5.3 PATENT, TRADEMARK OR COPYRIGHT

.1 The Supply Contractor represents that it has fully investigated all Specifications, including any furnished by the District, in connection with the Goods and based on such investigation and its past experience and superior knowledge with respect to such Goods has determined that the production and supply thereof will not infringe any patent, trademark or copyright.

.2 The Supply Contractor warrants to the District and its successors in interest that the manufacture, sale or use of the Goods and any services covered by this Contract, whether manufactured in accordance with the Specifications or otherwise, do not and will not infringe upon any patent, trademark or copyright. The supply Contractor shall save harmless and indemnify the Indemnified Parties from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature arising in any way from liability of any nature or kind for or on account of any copyrighted or uncopyrighted composition, secret or other process, patented or unpatented invention, articles or appliances manufactured or used in connection with the Goods, and

used or to be used by the District unless otherwise stipulated in this Contract, and if the Supply Contractor shall fail to save harmless and indemnify in manner aforesaid, any money collected from the Indemnified Parties shall be charged to the Supply Contractor.

Part 6 **Shipment of Goods/Damage to Goods**

6.1 **SHIPMENT OF GOODS**

.1 Delivery of Goods

.1 The Supply Contractor must deliver the Goods to the Delivery Point. Delivery of the Goods to a carrier for transmission to the Delivery Site does not constitute delivery of the Goods to the District. Any such carrier is deemed to be the Supply Contractor's agent and not the District's agent.

.2 Delivery Costs

.1 The Supply Contractor is responsible for all costs and expenses whatsoever in relation to the supply and delivery of the Goods to the Delivery Point, including without limitations, all shipping, carrier, transportation, freight, insurance, storage, handling costs, as well as any customs or excise charges or duties.

.3 Supply Contractor to Bear Risk

.1 The Supply Contractor shall bear all risks and shall assume all responsibility for the Goods, including, without limitation, any loss or damage to the Goods from any cause whatsoever, up to and including the delivery of the Goods at the Delivery Point.

.4 Loss or Damage

.1 If loss or damage to the Goods occurs for which the Supply Contractor is responsible, the Supply Contractor shall immediately effect repairs or replace any property as necessary in order to make good any such loss or damage. If the Supply Contractor refuses or neglects to do so, the District may make good any such loss or damage, either by itself or by employing some other person, and the expense of doing so shall be charged to the Supply Contractor. If any repair or replacement of property is performed on the Goods as a result of loss or damage to the Goods for which the Supply Contractor is responsible the Supply Contractor agrees that the warranty provided in Section 00 50 00 Clause 4.4 shall not be affected or changed to any manner or respect whatsoever.

.5 Acceptance of Delivery of Goods by District

.1 Notwithstanding any other provision in the Contract Documents, the District is not deemed to have accepted the Goods until the Goods have been delivered to the Delivery Point and the District has had a reasonable opportunity of examining them for the purpose of ascertaining whether they are in conformity with the Contract and has confirmed such acceptance in writing. The District's acceptance of the Goods shall not prejudice any rights or remedies the District may have hereunder relating to Goods that are found to be non- conforming, unsatisfactory, defective, of inferior quality or workmanship, or which fail to meet any specifications or requirements of the Contract Documents.

Part 7 Progress and Completion

7.1 CONTRACT TIME

.1 Prosecution of the Goods

.1 Time shall be strictly of the essence. The Supply Contractor shall supply the Goods in accordance with the Contract Documents. The Supply Contractor acknowledges that the schedule for supply of the Goods as set out in the Contract Documents is reasonable.

.2 Schedule

.1 The Supply Contractor shall provide a schedule and reports for scheduling and co-ordinating the supply of Goods within the prescribed time. Contract time extensions, if any, shall be incorporated into updated schedules. The failure of the Supply Contractor to comply with this requirement shall entitle the District to terminate the Supply Contractor's right to continue with the supply of Goods or to delay progress payments.

7.2 TERMINATION

.1 The District may terminate the Contract if the Supply Contractor at any time becomes bankrupt, makes an assignment of his property for the benefit of his creditors, or if a receiver or liquidator should be appointed. Such termination shall be effective upon the District giving notice thereof.

.2 If at any time the District forms the opinion that the Supply Contractor is in default under this Contract because the Supply Contractor:

.1 has breached any provision of the Contract ;

.2 has failed to supply the Goods, within the time specified in the Contract Documents;

.3 has failed or is failing to furnish or to maintain a detailed schedule;

.4 has become in any way unable to supply the Goods or any part thereof;

.5 has repeatedly failed to make prompt payments to subcontractors, suppliers or others for labour, materials or equipment;

then the District may give notice in writing to the Supply Contractor of such opinion and require that such default or defaults be remedied forthwith. If, within five Days of such notice, such default or defaults are not remedied to the satisfaction of the District, the District may terminate the Contract. Such termination shall be effective immediately.

.3 Upon termination pursuant to Section 00 50 00 Clause 7.2.1 or 7.2.2 the District may take all Goods out of the Supply Contractor's hands and employ such means as the District may see fit. In such case:

.1 The Supply Contractor shall have no claim for any further payment in respect of the Goods;

.2 No objection or claim shall be raised or made by the Supply Contractor by reason of or on account of the ultimate cost of the Goods so taken over for any reason proving greater than, in the opinion of the Supply Contractor, it should have been;

.3 Notwithstanding Part 8 all materials and all rights, proprietary or otherwise, licences, powers and privileges, whether relating to or affecting real or personal

property, acquired, possessed, or provided by the Supply Contractor for the purposes of supply of the Goods will become or remain and be the property of the District for all purposes incidental to the completion of supply of the Goods and may be used, exercised, and enjoyed by the District as fully to all intents and purposes connected with supply of the Goods as they might theretofore have been used, exercised, and enjoyed by the Supply Contractor;

.4 The District may assign all rights and privileges granted to the District in this clause to another supply contractor retained by the District to continue with the supply of the Goods.

.5 If the Supply Contractor's right to supply the Goods is terminated in accordance with the provisions of this clause, the Supply Contractor shall not be entitled to receive any further payment until the supply of Goods is completed.

.4 Except as herein before provided, the Supply Contractor shall have no claim against the District for any reason whatsoever by reason of the termination of the Contract.

Part 8 **Payment**

8.1 **PAYMENTS TO SUPPLY CONTRACTOR**

.1 Payments to the Supply Contractor will be made on the basis of the Schedule of Quantities and Prices, Schedule 1 of Section 00 20 00 Tender Form. Refer to Section 01 27 00 – Measurement and Payment as to description of how payments will be made.

.2 Notwithstanding Clause 8.1.1 the District may withhold from any payment:

.1 Any deduction the District may be entitled to under the Contract;

.2 Such amount as the District determines appropriate with respect to secure the correction or completion of any obligation under the Contract not properly or satisfactorily completed in compliance with the Contract Documents; and

.3 Amounts required to be held back pursuant to the Builders Lien Act (British Columbia).

.3 Payments may be withheld until the relevant operating manuals and all operating and maintenance materials together with all warranties have been delivered to the Engineer.

.4 In addition to any other remedy the District may have in the Contract or law, the District may refuse to make payment because of subsequently discovered evidence or test results, and shall be compensated for any payment previously made to the Supply Contractor to such extent as may be necessary to protect the District from loss as a result of:

.1 Defective or damaged Goods;

.2 A deductive change order;

.3 Failure of the Supply Contractor to supply the Goods in accordance with the Contract Documents, including failure to maintain the supply of the Goods in accordance with the schedule;

.4 Disregard by the Supply Contractor of the authority of the Engineer or the laws of any public body having jurisdiction.

The District may refuse to make payment of the full amount because of claims made against the District on account of the Supply Contractor's performance or supply of Goods. In such case, the District shall give the Supply Contractor prompt written notice stating the reasons for each action.

.5 The District, may withhold from payment to the Supply Contractor:

.1 Any set-off the District may be entitled to under the Contract;

.2 The amount of any bona fide builder's lien claim asserted against the District or which the District acting reasonably anticipates will be made against the District.

.6 Prior to payment to the Supply Contractor, if requested by the District, the Supply Contractor shall deliver to the District a statutory declaration in form satisfactory to the District declaring that all subcontractors, labour and accounts for material and equipment have been paid and that no persons have any lien against the lands comprising the Delivery Point or the work together with such other documentation as the District, acting reasonably, determines is necessary or desirable.

.7 Builders Liens

.1 The Supply Contractor shall, at its own cost and expense, cause any and all builders liens and other liens for labour, services or materials alleged to have been furnished in connection with the supply of the Goods to the lands comprising the Delivery Point which may be registered against or otherwise affect the said lands or the supply of Goods, to be promptly discharged from title to such lands.

8.2 WHMIS

.1 The Supply Contractor must comply with all requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of material safety data sheets in accordance to all applicable laws.

.2 The Supply Contractor must deliver copies of all relevant material safety data sheets to the Engineer upon delivery of goods.

END OF SECTION

Part 1 **General**

1.1 **SCOPE**

.1 Work specified in this section includes the design, supply, fabrication, assembly, performance testing at the manufacturer's facility, delivery to the Delivery Point of the Goods, testing, commissioning and operations training of a screw conveyors and equipment, as described elsewhere in the Specifications.

.2 The Work to be done under this contract consists of the design, fabrication, assembly, supply, delivery, assistance with installation, testing, commissioning and operations training of screw conveyor equipment as herein specified.

.3 The Goods will be installed under a separate contract. The Supply Contractor shall furnish all labour, materials, accessories and necessary parts to supply, fabricate, and deliver the Goods.

1.2 **REFERENCES**

.1 Section 01 33 00 – Submittals.

1.3 **SUBMITTALS**

.1 Submittals – Shops Drawings Prior to Fabrication

.2 Any manufacturing done before the review of the shop drawings by the District will be at the Supply Contractor's risk. The District shall have the right to require the Supply Contractor to make any changes in the Supply Contractor's drawings, which may be necessary, in the opinion of the District, to make the finished product conform to the requirement and intent of the Specifications, without additional cost to the District.

1.4 **DATES OF DELIVERY**

.1 The date(s) for delivery of the Goods to the Delivery Point as required by the District, or at such other date(s) of delivery as may have been proposed by the Supply Contractor in this Tender and agreed to by the District, as indicated in Section 00 20 00 – Schedule 2, defined the latest time the District can begin its process of installing and commissioning of the Goods.

.2 Should the Supply Contractor fail to meet the accepted Contract delivery date(s), he will be held liable for all costs incurred by the District that are attributable to the late delivery of the Goods.

1.5 **PLACE OF DELIVERY**

.1 Delivery Point: (See Section 00 50 00, Part 6) Sooke Waste Treatment Facility; 7113 West Coast Road, Sooke, BC, V9Z 0S2,

, BC. as defined in Section 00 10 00 Clause 1.2.3.

.2 Specific on-site delivery location to be confirmed by and coordinated with the District and General Contractor (once selected) prior to shipment to the Delivery Point. Delivery of the Goods shall take place during regular working hours (Monday through Friday, 07:00 to 15:30 hours).

.3 Two (2) weeks' notice shall be given to the General Contractor prior to intended delivery so that arrangements can be made for unloading and storing the Goods.

.4 The General Contractor will arrange to provide reasonable access to the site. The Supply Contractor is responsible for arranging off-loading of the Goods at the Delivery Point and shall allow

.5 One and a half (1.5) hours free waiting time for each load arriving at the site. This free hour and a half (1.5) will commence at the time of arrival at the site requested by the District, or at the actual time of arrival, whichever is later. Waiting time in excess of one and a half (1.5) hours will be paid for by the District at the normal rate of hire for the truck less 25 percent, provided that a claim shall be made within two (2) working days.

1.6 RATES OF DELIVERY

.1 The District may change the schedule or sequence of the fabrication and delivery of the Goods to best suit the District's installation and commissioning program. The Supply Contractor shall adjust its manufacturing and delivery schedule for the Goods to the Delivery Point in response to reasonable requests from the District, such that the amount of re-handling of the Goods is minimized.

.2 If required by the District to suit the construction schedule, delivery of the Goods shall be made in multiple deliveries over time, as necessary, during this time frame to minimize the time that Goods are stored on-site prior to installation.

1.7 HANDLING

.1 The Supply Contractor shall assume full responsibility for protection and safekeeping of all Goods supplied under this Contract until such time as they are delivered to the Delivery Point, at which time the District will assume full responsibility for protection and safekeeping of the Goods after they have been off-loaded from the delivery vehicle(s). The Supply Contractor shall be responsible for the Goods while in transit to the Delivery Point and off-loading the Goods at the Delivery Point.

.2 Any damage which may be done in handling, shipping, or off-loading at the Delivery Point shall be made good by the Supply Contractor at its expense and any cost that the District shall be put to by reason of such damage will be charged to the Supply Contractor.

.3 The District will inspect the Goods upon delivery to the Delivery Point, and the Supply Contractor will be notified promptly of any damage prior to off-loading. The District will be responsible for handling and storage of the Goods at the Delivery Point, and any re-handling prior to installation.

.4 Any Goods, which do not pass the appropriate standards or are subsequently found to be defective, will be returned to the Supply Contractor at the Supply Contractor's own expense.

1.8 QUALITY ASSURANCE TESTS

.1 Additional quality assurance testing will be at the discretion of the District upon initial inspection of the Screw Conveyor Equipment at the Delivery Point. Refer to Section 01 43 00 – Quality Assurance.

.2 Quality assurance tests will include any tests that the District may deem necessary to ensure the Goods will perform as required, and those required by the Specifications.

.1 The District may employ an independent testing firm to conduct quality control tests to determine compliance of the Work with the Contract Documents. Should material or workmanship be found to be unacceptable, the full cost of further testing relating to the deficiency shall be charged to the Supply Contractor.

.2 The Supply Contractor shall have no claim for delays, interruptions, double handling of materials, rejection of materials, or any other cause brought about by such tests, including awaiting the outcome of such tests.

.3 The Supply Contractor shall provide adequate notice to the Engineer to permit testing to be conducted at appropriate times in an efficient manner.

.4 Unless otherwise specified, the costs of testing will be assumed by others. In the event of a failed test the cost of retesting shall be borne by the Supply Contractor.

.5 The Supply Contractor shall provide material samples to the Engineer in such quantities as required for testing for conformance with the specification. The Supply Contractor shall make good to at least the original standard any area from which material samples are taken.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section refers to the measurement and payment of the work unique to the supply and delivery of the Goods described herein. This section must be referenced to and interpreted in conjunction with all other sections in the Contract Documents.

.2 Descriptions contained in the payment clauses provide a general description of the tasks.

.3 They are not meant to limit the Work.

.4 The items mentioned in this section refer to the items so numbered in Section 00 20 00 Schedule 1 – Quantities and Prices.

1.2 SUBMITTALS

.1 Monthly Invoice(s)

.1 The Supply Contractor shall submit an invoice at the end of each calendar month for all of the Goods delivered and accepted during that month.

.2 The invoice shall clearly indicate applicable taxes; the purchase order number; the amount of the invoice including any holdbacks and the amount billed to date.

1.3 DESCRIPTION OF PAYMENT ITEMS

.1 The prices proposed in Section 00 20 00 Schedule 1 shall include the cost of all applicable submittals, labour, material, equipment; and other expenses necessary for supplying the Screw Conveyor equipment, manufacturer performance tests and for performing all other work necessary and incidental to the supply and delivery of the items specified in this Tender as required to achieve the design alignment as indicated on the drawings and specifications. The prices shall include all taxes other than GST, freights, duties, brokerage fees, and similar charges.

.2 The Supply Contractor will be paid at the prices submitted in Section 00 20 00 Schedule 1 – Quantities and Prices– Tender Form for such amounts or quantities of each classification of product as are delivered and reviewed by the Engineer from time to time.

.3 The Supply Contractor shall make no claim for anticipated profits, loss of profit, damages, or any extra payments whatsoever, except as expressly provided otherwise herein, because of any difference between the amounts of material actually furnished and the estimated amounts as herein set forth.

1.4 PROGRESS PAYMENTS

.1 Progress payments will be made on the following basis:

.1 For delivery of the shop drawings, of each item in Section 00 20 00 Schedule 1, Quantities & Prices, the Supply Contractor will be paid ten percent (10%) of the accepted price for the item(s) received, less any amount the District is entitled to withhold pursuant to the Contract Documents.

.2 For each item in Section 00 20 00 Schedule 1 – Quantities & Prices, thirty (30) days after delivery of the Goods to the Delivery Point and receipt of an invoice, whichever is later, the Supply Contractor will be paid eighty percent (80%) of the accepted price for the item(s) received, less any amount the District is entitled to withhold pursuant to the Contract Documents.

.3 Thirty (30) days after the commissioning, satisfactory to the District, of the Goods following completion of the Construction Contract or upon receiving all outstanding submittals, deliverables, compliance report, and invoice, whichever is later, the Supply Contractor will be paid the remaining ten percent (10%) of the accepted price, less any amount the District is entitled to withhold pursuant to the Contract Documents. The Construction Contract is intended to be commissioned by the end of March 2020.

1.5 CHANGE ORDERS, SUPPLY CONTRACTOR'S RESPONSIBILITIES

.1 The Supply Contractor shall complete and promptly return all Change Order price requests issued by the District. Include appropriate supporting documentation to verify prices.

.2 The Supply Contractor shall not proceed with work affected by a change order price request until authorized to do so by Change Order.

.3 The Supply Contractor shall make no change in the supply of Goods unless a Change Order is issued.

.4 Change Orders are only valid when signed by the District.

END OF SECTION

Part 1 **General**

1.1 **DESCRIPTION**

.1 This section describes the Supply Contractor's responsibilities for making submittals to the Engineer to demonstrate that materials, equipment, methods, and work comply with the provisions and intent of the Contract Documents.

.2 The Supply Contractor shall provide submittals in accordance with this section and as specified in Section 01 10 00, Clause 1.3.

.3 Submittals covered by this specification include manufacturers' information and technical data sheets, descriptive data, certificates, product data, shop drawings, test procedures, test results, samples, all mechanical, electrical and electronic equipment and systems, fabricated items and miscellaneous work-related submittals.

.4 The Engineer may require additional submittals from the Supply Contractor when, in the opinion of the Engineer, such additional submittals are warranted.

.5 The Supply Contractor shall notify the Engineer, in writing, when re-submitting any revisions other than those requested by the Engineer.

.6 Where submittals are required in any Section, they shall be submitted by the due date specified in Schedule 2 Section 00 20 00.

.7 Execution shall not commence until the Supply Contractor has received the District's comments on its submittals and has been advised to commence the work. The District's or Engineer's review of the submittals does not relieve the Supply Contractor of his duties and responsibilities as specified under Section 00 50 00 – General Conditions of this Contract.

1.2 **SUBMITTAL REQUIREMENTS**

.1 Each submission shall be coordinated with the requirements of the Work and the Contract Documents. Individual submissions will not be reviewed until all related information is available.

.2 Make submittals far enough in advance to allow adequate time for coordination, review, revisions and re-submittals, and for the supply and delivery of the Goods.

1.3 **SCHEDULE**

.1 The Supply Contractor shall submit a proposed schedule for review within two (2) weeks from Notice of Award. The schedule shall include all submittal dates, manufacturing, testing, and delivery of the Goods.

1.4 **SUBMITTAL CATEGORIES**

.1 Submittals fall into two (2) general categories:

.1 Submittals for review.

.2 Submittals for information only.

1.5 SHOP DRAWINGS

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Supply Contractor to illustrate details of a portion of the Work.

.2 Detail all shop drawings using the metric system. Prepare to a drafting standard equivalent to the Contract drawings.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, wiring diagrams, panel layouts with bills of material, explanatory notes and other information necessary for completion of Work. Where articles and equipment attach or connect to other articles or equipment, indicate that such item have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross reference to design drawings and specifications.

.4 Adjustments made on shop drawings by the Engineer are not intended to change the Contract Amount. If adjustments affect the value of Work, state such in writing to the Engineer prior to proceeding with the Work.

.5 Make such changes in shop drawings as the Engineer may require, consistent with Contract Documents. When resubmitting, notify the Engineer in writing of any revisions other than those requested.

.6 Submit four (4) "white print" copies of product data sheets or brochures for requirements requested in specification Sections and as the Engineer may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.7 The Supply Contractor shall submit a minimum of four (4) hard copies and one (1) electronic copy of each drawing to the Engineer for his review. The Engineer will retain two (2) copies of each drawing.

.8 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings shall be submitted together, to enable the Engineer to review the drawings as a package.

.9 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular material.

.10 Manufacturers' catalogues, manuals, or price list will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

.11 Indicate the tag number of instructions and values and clearly show the features and details applicable to the equipment being supplied.

.12 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring the seal of a Professional Engineer registered in the Province or Territory where the work is located, in accordance with the applicable provincial or federal engineering acts or other governing legislation. Seal such drawings

before submitting them for review. Submit for review engineering calculations signed by the registered Professional Engineer responsible for the shop drawing design elements.

.13 If, upon review by the Engineer, no errors or omissions are discovered or if only minor corrections are made, one (1) stamped electronic copy will be returned and fabricated and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings must be performed before fabrication and installation of Work may proceed.

.14 Use only those shop drawings on the work that bear the Engineer's "REVIEWED" notation.

.15 District may deduct, from payments due to Supply Contractor, cost of additional Engineering work incurred if correct shop drawings are not submitted after one review by Engineer.

.16 Review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that the Engineer approves the detail design inherent in the shop drawings, responsibility for which remains with the Supply Contractor, and such review does not relieve the Supply Contractor of his responsibility for errors and omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Supply Contractor is responsible for dimensions to be confirmed and correlated at the job-site, for information that pertains solely to the fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

.17 The specifications identify those items for which shop drawings shall be submitted.

1.6 PRODUCT DATA

.1 Product data shall include manufacturer's catalogue sheets, brochures, literature, performance charts and manufactured products. Refer to Specifications for Specific Requirements.

.2 Submit four (4) hardcopies and one (1) electronic copy of all product data.

Part 2 Products

2.1 TRANSMITTAL FORM

.1 Accompany all submittals with a standardized transmittal form for each specific item, class of material, equipment and items specified in separate, discrete sections in duplicate containing:

.1 Date;
.2 Contract number;
.3 Project title and number;
.4 Equipment number;
.5 Supply Contractor's name and address;
.6 Identification and quantity of each shop drawing;

.7 Name and address of:

.1 Subcontractor;

.2 Supplier;

.3 Manufacturer;

.4 Other pertinent data.

.2 Identify the Section in the Specifications or the Drawing number to which the Submittal refers to.

.3 Assign a unique number, sequentially assigned, on the transmittal form accompanying each item submitted. Submittals will be classified according to categories agreed to by the Supply Contractor and District. Use the following format by category for submittal numbers: "XXX", where "XXX" is the sequential number assigned by the Supply Contractor. Resubmittals will have the following format: "XXX-Y", where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for re-submittals, i.e., A, B, or C being the 1st, 2nd, and 3rd re-submittals, respectively. Submittal 025-B, for example, is the second re- submittal of submittal 25.

Part 3 Execution

3.1 ADMINISTRATIVE

.1 Provide to the Engineer for review the submittals specified. Submit all information promptly and in an orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.

.2 Submit four (4) copies of submittals, unless noted otherwise in these specifications.

.3 Do not proceed with work affected by any Submittal until review is complete. Normally, submittals for review and comment will be returned to the Supply Contractor within seven (7) days of receipt, exclusive of any time awaiting clarification or further information; however, the time for returns may vary and may exceed seven (7) days depending upon the complexity of the Submittal, the number of submittals, and the express needs of the Supply Contractor.

.4 Review all submittals prior to submission to the Engineer including those from subcontractors and suppliers. The Supply Contractor’s review represents to the District that the necessary requirements have been determined and verified, or will be, and that each Submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified by the Supply Contractor will be returned without being examined and will be considered rejected.

.5 The Supply Contractor is responsible for the accuracy and completeness of information submitted. The Supply Contractor shall notify Engineer in writing of materials, equipment or methods of work that deviates from the Contract Documents. Notification in writing, to accompany Submittal transmittal and noted under deviations.

.6 The Supply Contractor's responsibility for errors, omissions and deviations in submission is not relieved by the Engineer's review of Submittals.

.7 Keep one (1) reviewed copy of each submission at the Work Site.

.8 All shop drawings shall be prepared in metric units.

.9 The Supply Contractor shall maintain a single schedule of the status for all Submittals. This schedule shall be kept up-to-date and presented to the District for each item submitted.

.10 Submittals requiring re-submission shall be submitted with their entire respective document section or tab to assist in document tracking in regard to the most current revision number. Piecemeal submittals will not be accepted and will be returned without review.

3.2 SUBMITTALS FOR REVIEW

.1 All submittals, except where specified to be submitted for information only, are to be submitted by the Supply Contractor to the Engineer for review.

.2 Review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept in accordance with the Specifications. This review does not mean that the Engineer approves the detail design inherent in the Submittals, Shop Drawings and data sheets, responsibility for which remains with the Supply Contractor, and such review does not relieve the Supply Contractor of its responsibility for errors or omissions in the Shop Drawings and data sheets or of its responsibility for meeting all requirements of the Contract Documents.

.3 Indicate all materials, methods of construction, methods of attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for the supply of the Goods and the installation thereof. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co- ordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross references to Drawings and Specifications.

.4 Submittals for review will be returned to the Supply Contractor with one of the four following notations:

.1 If the review indicates that the material or equipment complies with the contract documents, submittal copies will be marked "Reviewed". In this event, the Supply Contractor may begin to implement the work method or incorporate the material or equipment covered by the Submittal.

.2 If the review indicates limited modifications are required, copies will be marked "Reviewed as Modified". The Supply Contractor may begin implementing the work method or incorporating the material and equipment covered by the Submittal in accordance with the noted corrections. Where Submittal information will be incorporated in operation and maintenance data, the Supply Contractor shall provide a corrected copy.

.3 If the review reveals that the Submittal is insufficient or contains incorrect data, copies will be marked "Revise and Resubmit". Do not undertake work covered by this Submittal until it has been revised, resubmitted and returned marked either "Reviewed" or "Reviewed as Modified".

.4 If the review indicates that the material, equipment, or work method does not comply with the Contract Documents, copies of the Submittal will be marked "Rejected". Submittals with deviations, which have not been previously identified

clearly may be rejected. Do not undertake the work covered by such submittals until a new Submittal is made and returned marked either "Reviewed" or "Reviewed as Modified".

.5 After submittals are stamped "Reviewed" or "Reviewed as Modified", no further revisions are permitted unless re-submitted to the Engineer for further review.

.6 If upon review by the Engineer, no errors or omissions are discovered or if only

.7 Minor corrections are made, one (1) stamped copy noting “Reviewed or Reviewed as Modified” will be returned and fabrication and supply of the Goods may proceed. If shop drawings and data sheets are rejected, the one (1) stamp copy noting “Revise and Resubmit or Not Reviewed” will be returned, and resubmission of corrected shop drawings and data sheets, through the same procedure indicated above, is to be performed before fabrication of the Goods may proceed.

.8 The District may deduct, from payments due to Supply Contractor, costs of additional Engineering reviews incurred if shop drawings and data sheets are not corrected after one review by the Engineer.

3.3 SUBMITTALS FOR INFORMATION ONLY

.1 Submittals for information only will be used by the Engineer for general information and filed without comment. The Engineer retains the right to return submittals for information only if the Submittal does not comply with the Contract Documents and general design criteria.

.2 Submittals for information only are not subject to review procedures. They are to be provided as part of the Work under the Contract and their acceptability determined under normal inspection procedures.

.3 Where specified, the Supply Contractor is to submit engineering calculations sealed by a qualified Professional Engineer for information only.

3.4 ELECTRONIC DRAWING FORMATOF FINAL/CERTIFIED SHOP DRAWINGS

.1 Electronic drawing files are to be AutoCAD 2014 format to District of Sooke standards. An electronic template drawing in paper space with the District’s standard border and drafting standards will be provided to the Supply Contractor upon request after award.

.2 Submit electronic drawing files on CD-ROM or USB memory stick.

END OF SECTION

Part 1 **General**

1.1 **SCOPE**

.1 This section contains the general requirements of the District's quality assurance program as well as procedures used by the District to check the Supply Contractor's Quality Control Program.

1.2 **QUALITY ASSURANCE**

.1 The District may itself carry out inspections, measurements, and testing of the Work in order to assure that the quality of the Work is in accordance with the requirements of the Contract Documents, and to check and verify the quality control results and records of the Supply Contractor's Quality Control Program.

.2 All or any part of the Work, and any off-site locations where material or products for the Work are being prepared or stored, may be inspected by the Engineer when and as often as deemed expedient in order to meet the objectives of quality assurance.

1.3 **ACCESS FOR INSPECTION AND TESTING**

.1 The District shall be granted access to the Work at all reasonable times. If parts of the Work are in preparation at locations other than the Work Site, the Supply Contractor shall, at the request of the Engineer, arrange for safe access to such locations for the purposes of granting the Engineer the opportunity to undertake quality assurance inspections and/or tests.

.2 The District shall give the Supply Contractor timely notice of the Engineer's intention to carry out any specific inspections and tests on any aspects of the Work. The Engineer may, however, carry out routine inspections and tests on any part of the Work without notice.

.3 Once notice has been given by the District, the Supply Contractor shall not by any means prevent access to, or deny access to, Work that has been selected for specific tests, inspections or approvals. If the Work has continued without testing, inspection or approvals, the Supply Contractor shall undo such Work to the point where testing, inspection or approvals were to be performed at no additional cost to the District.

.4 The District may wish to inspect or test sections of the Work which have already been completed prior to any previous inspections. The costs of testing such Work will be borne by the District, unless the section of Work is found to be in non-conformance with specified quality requirements, in which case the costs shall be borne by the Supply Contractor.

1.4 **INDEPENDENT TESTING AGENCIES**

.1 The District may appoint an independent testing agency to undertake quality assurance inspections or tests on any parts of the Work. The Supply Contractor shall grant to any such agency the same access privileges as are required to be given to the District. The costs of hiring an independent testing agency will be borne by the District.

.2 The employment of independent testing agencies by the District shall in no way absolve the Supply Contractor of its responsibility to perform the Work in accordance with the quality requirements of the Contract Documents, and to conduct all necessary quality control inspections and testing.

1.5 **NON-CONFORMANCE**

.1 Work that does not meet the quality requirements of the Contract Documents will be rejected.

.2 Unacceptable quality may result from poor workmanship, improper construction procedures, non- compliance with manufacturer's instructions, improper and careless handling, and the use of defective or damaged products and/or materials.

.3 The Supply Contractor shall rectify all sections of the Work that are found, as a result of quality assurance inspections and tests, to be in non-conformance with the quality requirements of the Contract Documents. Where it is not possible or practical to repair a non-conforming or defective material, product, or component of the Work, to the satisfaction of the District, that material, product or component shall be removed from the Work and a new replacement be provided.

.4 Where a section of the Work, or a product, is found to be in non-conformance, the Supply Contractor shall be responsible for all the costs of rectifying, replacing, re- inspecting and re-testing the Work to bring it to conformance. The District shall have the right to deduct the costs of all re-inspection and re- testing carried out by the District from progress payments due to the Supply Contractor.

.5 Where a section of the Work, or a product, is found to be in non-conformance by quality assurance testing, the Supply Contractor shall increase the frequency of quality control testing on adjacent areas or similar products.

.6 The Supply Contractor may challenge the results of any quality assurance tests indicating non- conformance. The section of Work in question shall be re-tested by an independent testing agency acceptable to both the Supply Contractor and District. Should the retest confirm the results of the earlier test, the Supply Contractor shall bear the costs of the additional tests. Should the re-test indicate conformance with the required quality standards, the District shall cover the costs of the tests.

Part 2 **Products**

Not applicable to this Section.

Part 3 **Execution**

3.1 **SPECIFIC QUALITY ASSURANCE TESTS**

.1 Refer to the Specifications for Specific Quality Assurance Tests to be carried out by the Supply Contractor.

.2 The Specifications may call for specific quality assurance tests to be performed on the Work by the District. The Supply Contractor shall give the District, or its appointed

independent testing agency, appropriate notice as to when the Work will be ready for such tests. The District will not be responsible for delays occasioned by the Supply Contractor's omission in giving the required notice.

.3 The Supply Contractor shall submit samples of materials, products or equipment required for testing where specifically called for in the Specifications. These items shall be submitted promptly and in an orderly sequence so as not to cause delay to the Work.

.4 The Supply Contractor shall provide sufficient labour and facilities to obtain and handle samples of materials, products and equipment required for test. The Supply Contractor shall also provide sufficient space to store, and where necessary cure, test samples and products.

3.2 REPORTS

.1 At the request of the Supply Contractor, the District shall submit to the Supply Contractor copies of results of any quality assurance tests undertaken by the District or by its appointed independent testing agency.

.2 The Supply Contractor shall provide copies of inspection and test results to its subcontractors and suppliers where quality assurance tests were performed on materials, products, or work supplied or undertaken by them.

.3 The Supply Contractor shall provide copies of the reports required for the specific Quality Assurance tests listed in the Specifications.

END OF SECTION

Part 4 **General**

4.1 **SCOPE**

.1 This section outlines the responsibilities of the Supply Contractor with respect to controlling the quality of the Work required to be completed under the terms of the Contract. The required quality standards for the various aspects of the Work are contained in the specific sections of these Contract Documents.

4.2 **SUBMITTALS**

.1 Within seven (7) days of the date of issue of the Notice of Proceed, the Supply Contractor shall submit a Quality Control Program to the District for review. The District will, within seven (7) days of receipt of the program, respond in writing to the proposed program. The Supply Contractor shall submit copies of test results to the District within twenty-four (24) hours of them becoming available. If the tests are completed on the Work Site, the Supply Contractor shall provide the District with a field memo summarizing the results immediately following testing.

4.3 **REQUIREMENTS**

.1 The Supply Contractor shall conduct, at its own cost, all necessary quality control testing that is required to demonstrate the Goods conforms to the Contract Documents.

.2 The Supply Contractor shall be responsible for all aspects of the quality of the Work and shall put into place a suitable Quality Control Program to ensure that quality standards are met, and that the Work meets the requirements and intent of the Contract Documents.

.3 The Supply Contractor shall appoint an independent testing agency to undertake quality control tests that are required by the Contract Documents, and for which the Supply Contractor does not have suitable resources and equipment.

.4 The independent testing agency used by the Supply Contractor shall be manned by qualified personnel and have facilities that are certified to CSA, ASTM and other specified test methods for the sampling and testing of materials. The independent testing agency requires the acceptance of the District.

.5 The District may carry out quality assurance testing and inspection in order to assure that Work is generally in accordance with the Contract Documents and to verify the Supply Contractor's quality control data.

.6 Testing and inspection by the District will not relieve the Supply Contractor of its responsibility to perform quality control testing and inspection.

4.4 **PAYMENTS AND DELAYS**

.1 No separate or additional payment will be made to the Supply Contractor for quality control. The costs thereof will be considered to be included in the proposal prices for the various items of work to be performed under the Contract. Likewise, no extension of time

shall be allowed for any delay occasioned by the need to carry out inspection and testing, or to rectify work in non-conformance with quality standards.

Part 5 Products

Not applicable to this Section.

Part 6 Execution

6.1 QUALITY CONTROL PROGRAM

.1 The Supply Contractor shall develop a Quality Control Program, which shall be submitted to the District for review.

.2 The program shall include, but not be limited to, the following:

.1 The names and designations of persons employed by the Supply Contractor who will be responsible for quality control and what each person's function will be.

.2 The name of an independent inspection and testing agency that will be used to monitor the quality of the Work.

.3 The procedures that will be adopted by the Supply Contractor to ensure conformance with the requirements of the Specifications and Drawings.

.4 The procedures for the control of items purchased by the Supply Contractor to ensure that they are of specified quality and size, and procedures for the proper care and storage of such items on site before inclusion in the Work.

.5 The procedures for the control of documents and drawings to make sure that only the latest revisions are used, and that the contents of change orders, instructions, minutes, etc., issued by the District, are followed.

.6 Inspection and testing methods, including testing of materials, welds, valve leakage, etc., and a description of what methods will be used if not specifically listed in the Contract Documents. The proposed locations and frequencies of testing shall also be indicated.

.7 A description of how non-conformance with quality standards or project specifications will be tracked and what remediation methods will be followed to achieve conformance.

.8 The procedures for the control, distribution, and safekeeping of all quality testing and inspection records.

.3 All Work shall be performed in strict adherence to the accepted Quality Control Program.

6.2 QUALITY CONTROL TESTING

.1 The Supply Contractor shall conduct, at its own cost, all necessary quality control tests that are required to demonstrate that the materials, products, and completed Work conform to the Contract Documents.

.2 The Quality Control Measures listed in the Specifications are a minimum only. The Supply Contractors Quality Control Program and testing shall include such tests required to prove the functionality and safety of the equipment.

.3 Minimum quality standards and testing requirements shall be in accordance with the Contract Documents, and if not stated therein, with all applicable laws, regulations, standards and codes.

.4 The locations and frequencies of tests required under this section shall be determined by the Supply Contractor and/or the independent testing and inspection agency working on behalf of the Supply Contractor and shall be selected to test all aspects of the Work.

.5 The Supply Contractor shall report, track, correct and retest any deficient Work determined by the quality control or quality assurance programs at no additional cost to the District.

.6 The Supply Contractor's quality control testing and the District's quality assurance testing will form the basis for acceptance of the Work.

.7 All test reports shall contain at least the following information:

.1 Project identification;
.2 The nature of the test;
.3 Dates of sampling, testing and reporting;
.4 The names of the personnel involved;
.5 The location of the test (with sketch if required);
.6 The specified quality standard required;
.7 The test results achieved; and
.8 Remarks regarding conformance or non-conformance with the specified requirements.

END OF SECTION

Part 1 General

1.1 INTRODUCTION

.1 This specification outlines the minimum requirements for the design, fabrication, supply, testing and commissioning of Electrical equipment provided as part of a mechanical or process packaged system to be supplied by a Supplier for the Sooke Screw Conveyor Project at Sooke, British Columbia.

.2 The equipment defined within this specification includes but is not limited to the starters, motors, enclosures, cable, conduit and tagging standards as required for the packaged system.

.3 The services defined within this specification includes but is not limited to the supply, factory acceptable testing, delivery to site, installation support, testing (lead), commissioning (lead), training (lead) and collection of all support documentation.

.4 This specification is complementary to Equipment Data Sheets, drawings and specifications that may form part of the tender documents.

.5 It shall apply to those items installed on equipment and those items supplied loose by the Supplier.

.6 Refer to additional specification of common I&C elements.

1.2 DEFINITIONS

.1 **Contractor**: Site Installation Contractors or General Contractor

.2 **Supplier:** Equipment or Process System material provider or Supply Contractor

.3 **The Owner**: District of Sooke; the end user

.4 **Engineer**: Equipment Specifier

.5 "When specified", "Where specified" or "As specified" shall mean information shown on the accompanying Data Sheets or drawings by the Engineer.

1.3 LANGUAGE AND UNITS

.1 All documentation shall be provided in English.

.2 All units of measurement shall be in Imperial units.

.3 Where a component or piece of equipment is manufactured using the International Systems of Units (SI units), the SI units should be shown as the primary dimensions, with the Imperial equivalent shown in brackets.

1.4 CODES AND STANDARDS

.1 The design and installation of all instruments shall comply with the rules and provisions of the latest editions and amendments of the Standards and Codes of Practice listed below.

Document No.	Standard Title
ASME PTC 19.3,	Temperature Measurement
ASME B 40.100,	Pressure Gauges and Gauge Attachments
ASME B 40.200,	Thermometers, Direct Reading and Remote Reading
ASME Section VIII,	Pressure Vessels, Division I
ASTM E230	Standard Specification and Temperature-Electromotive Force (EMF) Tables of Standardized Thermocouples
ISA-S5.1	Instrument Symbols and Identification
ISA-75.01-1985	(R1995) - Flow Equations for Sizing Control Valves
ISA /ANSI-MC 96.1	Temperature Measurement Thermocouples
ISA 20	Instrument Specification Forms
ISA 75.02,	Control Valve Capacity Test Procedures
ISA 75.04,	Face-to-Face Dimensions for Flangeless Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.08,	Installed Face-to-Face Dimensions for Flanged Clamp or Pinch Valves
ISA 75.08.03	Face-to-Face Dimensions for Socket Weld-End and Screwed-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)
ISA 75.08.04	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (Class 4500)
ISA 75.08.07	Face-to-Face Dimensions for Separable Flanged Globe-Style Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.15	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (ANSI Classes 150, 300, 600, 900, 1500 and 2500)
ISA 75.16	Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (ANSI Classes 900, 1500, and 2500)
ISA 75.22	Face-to-Centreline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (ANSI Classes 150, 300, and 600)
UL 508A	Standard for Industrial Control Panels
NEMA 250	Enclosures for Electrical Equipment
CEC	Canadian Electrical Code (latest edition)
CSA	Canadian Standards Association ***(all electrical equipment shall bear the CSA label)***
API – RP551	American Petroleum Institute, Process Measurement Instrumentation
ANSI/ISA-7.0	Quality Standard for Instrument Air
ANSI B16.36	Steel Orifice Flanges

.2 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.3 Quality control is in accordance with the applicable International Standards Organization (ISO) standard.

.4 In addition to Codes and Standards listed above, the following requirements shall apply:

.1 All equipment and assemblies shall carry the CSA or equivalent mark approved for use by the local authority having jurisdiction (Safety Authority: Technical Safety BC, or AHJ) with an associated declaration of conformity. Note that the AHJ has a limited list of acceptable certification agencies.

.2 In the event that specific equipment does not bear an acceptable equipment certification, the Supplier shall obtain local review, inspection, approval and labelling by a certification agency such as CSA or equivalent that is acceptable to the authority having jurisdiction.

.3 The Supplier shall pay for all costs for local inspection and any equipment modification as directed by the certification agency to obtain approval.

.4 In case of a conflict between Standards, the CSA Standards take precedence in the interpretation of the requirements over other Standards.

.5 The design and construction shall also comply with the requirements of all authorities having jurisdiction over the site for the type of equipment specified herein.

1.5 CONFLICTS BETWEEN DOCUMENTS

.1 Conflicts between referenced documents shall be identified to the Engineer in writing for resolution. In general, the order of precedence is:

.1 Diagrams and Schedules

.2 Specifications (equipment) and Data Sheet

.3 Purchase Order

.4 This specification

.5 Referenced applicable standards

.2 In the event of any conflict between the Purchase Order, Specifications, Codes and Standards or lack of clear definition as to the applicability of any specification or standard, Supplier shall obtain a written clarification from the Owner before proceeding. The Owner's response and / or instructions shall subsequently form part of this Specification.

1.6 SUPPLIER INFORMATION

.1 The Owner's approval of Supplier's drawings and documentation does not in any way relieve the Supplier of his responsibility to meet the above criteria.

.2 The Supplier shall submit sufficient information (pressures, temperatures, flow rates, specific gravities, corrosive conditions, controller set points, alarm set points, ranges, etc.) to permit The Owner to execute the necessary review and checking activities and to develop control narratives, interconnecting diagrams, and shutdown and security circuits.

.3 Supplier shall provide, and The Owner shall review, interface drawings for complete compatibility with Supplier's equipment, interfacing with The Owner's electrical System and for safe functioning of the equipment.

1.7 DOCUMENTATION

.1 Provide drawings / data as referenced in the subsections below.

1.8 LOCATION DRAWINGS

.1 All field instruments and associated connections to equipment or process shall be shown in their proper locations on the following types of drawings:

.1 Piping Plans and Elevations; and

.2 Location Drawings.

1.9 DESIGN CONSIDERATIONS

.1 Supplier shall be fully responsible for furnishing instruments and instrument systems, meeting the following minimum design considerations:

.1 Meets the design requirements of the Packaged Equipment;

.2 Optimum Operation of Process;

.3 Suitable Quality;

.4 Suitable materials and coatings for the environment and conditions;

.5 Availability of support and spare parts;

.6 Reliability and proven technology;

.7 Quality Construction; and

.8 Safe Operability.

.2 The Engineer will review all sizing (based on information provided by the Supplier) prior to the Supplier purchasing the instrument. Review by the Engineer does not waive the Supplier's responsibility for suitable and safe design.

.3 Supply panel drawings for all panels supplied as part of the package. The drawings shall show equipment layout, dimensions, wiring, a bill of materials and tubing details. See Control Panels section below.

.4 Provide standard catalogue data (including technical specifications, wiring details, and instructions for maintenance, operation, and installation) for all equipment provided. Highlight information relevant to the actual instrument being used.

1.10 EQUIPMENT NUMBER AND TAGGING

.1 Label all field equipment with a 25 x 50 mm rectangular stainless steel labels stamped with the assigned tag numbers (6 mm high lettering). The Supplier shall affix the label to the equipment with drive pins or stainless steel wire in such a manner that it need not be removed for installation of the equipment.

.2 Follow Owner standards (available upon request).

.3 Wire numbering: Consistent with nomenclature used in available sample drawings.

1.11 EQUIPMENT INSTALLED IN HAZARDOUS AREAS

.1 All equipment and electrical devices that are fully or partially located within a hazardous area shall be suitably rated for the area classification.

.2 Conduit and cabling systems to instruments located in hazardous areas shall be in accordance with the CEC.

.3 Electrical equipment intended for use within a designated hazardous area shall meet the latest requirements of the Canadian Electrical Code C22.1, and as adopted in the Province of British Columbia.

.4 Provide all necessary certification for electrical equipment specifically designed for use in designated hazardous areas. A separate certificate shall be provided for all individual pieces of equipment.

.5 Ensure to reference the Area Classification drawings, where provided, to confirm the location of the equipment and the classification of the space where the equipment is installed.

.6 Equipment rating methods are discussed further in Part 2 of this document.

1.12 SUPPLIER RESPONSIBILITY

.1 The Supplier is responsible for the functionality and suitability of all equipment provided as a part of their scope supply, including equipment that is shipped loose for connection to the packaged system equipment.

1.13 SUPPLIER SCOPE

.1 Supply all electrical equipment required to operate the package systems that either mounts directly on the equipment or is field installed and wired to the systems.

.2 Prewire all field mounted equipment and devices to terminals in NEMA 4X junction boxes.

.3 Make provisions in the packaged control systems to interface to the plant electrical system as defined in the equipment specification.

.4 Provide onsite support to lead integration efforts of the equipment; this effort will coordinate with the site Contractor and the Client.

.5 Provide a testing program and site services to implement the testing of the system (dry and wet) with the Contractor and the Client.

.6 Provide a commissioning program and site services to implement the commissioning program of the system with the Contractor and the Client.

.7 Provide training material, trainer, and allow six training sessions for operations staff In accordance with Section 41 12 00 Clause 3.11 A classroom environment will be provided for the operations staff. Hands on training to be included in part of each sessions.

1.14 MATERIALS

.1 Equipment shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.15 ELECTRICAL APPROVALS

.1 Provide instruments and control devices rated for the area classification where the devices are to be installed.

.2 CSA labelling for all equipment, both fabricated in a shop and modified in the field during construction.

1.16 SUBMITTALS

.1 Submittals shall be in accordance with Section 01 33 00 requirements.

.2 The Supplier is to provide engineering assistance to The Owner and Engineer for various projects as they arise, as indicated below:

.1 The Supplier will be provided with design drawings (typically single line diagrams, floor plans and proposed equipment footprints) by The Owner or Engineer during the detailed design stage, along with a formal request to produce shop drawings and a cost estimate (refer to Section 01 33 00 for additional information).

.2 The Supplier is to provide engineered shop drawings and associated cost estimate, based upon the terms and specifications of this Tender with any changes or modifications requested by The Owner or Engineer.

.3 The Owner and/or Engineer will review the shop drawings and cost estimate, and work with the Supplier to make adjustments to the equipment, as required, to suit the project.

.4 The Supplier shall allow for three (3) such shop drawing submissions during detailed design.

.3 Submit shop drawings, product data and samples in accordance with Section 01 33 00. The submission shall be reviewed, signed and processed as described in Section 01 33 00.

.4 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.5 Where required in specific sections, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with existing equipment and the work required in other divisions.

.6 Content

.1 Shop drawings submitted title sheet.

.2 Data shall be specific and technical.

.3 Identify each piece of equipment with appropriate tag as per equipment identification list or schedule.

.4 Information shall include all scheduled data.

.5 Advertising and commercial presentation literature will be rejected.

.6 The project and equipment designations shall be identified on each document.

.7 Information shall be given in S.I. units.

.8 The shop drawings/product data shall include as a minimum:

.1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weight's and mounting point loads.

.2 Mounting arrangements showing clearances were needed

.3 Detailed drawings of bases supports and anchor bolts.

.4 Control explanation and internal wiring diagrams.

.5 A written description of control sequences relating to the schematic diagrams.

.6 Detailed bill of materials.

.7 Submission format:

.1 Black line prints 216 mm x 280 mm [letter size] or 280 mm x 430 mm [tabloid] for control schematics.

.2 Larger drawings may be submitted on reproducible single sheet media (ie not bound) with space for stamps and signatures - master set plus one working copy.

.3 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.

.8 No. of copies:

.1 Provide number of copies indicated in Section 01 33 00 with a minimum of two (2) copies to be retained by the Engineer.

.2 Preferred mode of shop drawing distribution is in electronic format (pdf file).

1.17 CARE, OPERATION AND START-UP

.1 Provide for instructing The District's operating personnel in the operation, care and maintenance of supplied equipment as specified as follows:

.1 Provide for the services of the manufacturer’s factory service engineer to participate in and supervise the start-up of the supplied equipment installation, and to check, adjust, balance and calibrate components.

.2 Provide these services for standard period, as necessary to put equipment in operation, and including training for operating personnel for all aspects of its care and operation. Include daily rates for any additional time Supplier would be required for completion of installation and commissioning beyond standard period.

1.18 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with these specifications.

.2 Equipment and materials shall be CSA certified.

.3 Factory assemble the control compartments and component assemblies.

1.19 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into Owner's final maintenance manual specified in Section 01 78 39 and as follows.

.2 Include in operations and maintenance data:

- .1 Operating instructions and start-up procedures including receiving and installation requirements.
- .2 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of supplied equipment.
- .3 Detailed instructions for the normal maintenance of all supplied equipment, including procedures and frequency of operational checks and service and troubleshooting instructions
- .4 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature is not acceptable.
- .5 Wiring and schematic diagrams: these must be specific to each individual piece of equipment, detailed with wire/cable tags and termination information, not generic.
- .6 Spare parts data shall be furnished for each item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply. A list and itemized price breakdown of spare parts recommended for stocking shall be furnished. The parts selected shall be those which, in the manufacturer's judgment, will be involved in the majority of maintenance difficulties encountered.
- .7 Copies of guarantees and certificates.
- .8 Names and addresses of local suppliers for each item of equipment, including items in the maintenance manuals.

.3 Submit a draft copy to the Engineer for approval prior to delivery of the equipment.

1.20 PROJECT AS-BUILT DRAWINGS

.1 During the construction period, the Installation Contractor will keep on-site a clean set of final shop drawings that will be marked-up to reflect the "As-Built" state of the equipment, for examination by the Engineer on a regular basis.

.2 Upon completion of commissioning, the Installation Contractor will provide the marked-up "as-built" shop drawings to the Supplier(s), to be updated in AutoCAD format.

.3 The Supplier is responsible for providing AutoCAD format "as-built" drawings which incorporate the Contractor's field mark-ups for each individual breaker and starter bucket. Typical wiring diagrams will not be accepted. The Supplier shall submit the as-built drawings in both paper and electronic format for incorporation into site O&M manuals.

1.21 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust-resistant primer inside and outside (or phosphatizing treatment), and at least 2 mil thick electrostatic powder paint coat applied to all surfaces.

.2 Paint indoor switchgear and distribution enclosures to ASA 61, light grey.

1.22 EQUIPMENT IDENTIFICATION

.1 Provide nameplates for electrical equipment having a standard Owner equipment number (to be provided in shop drawing reviews, and incorporated by the Supplier) with the following characteristics:

.1 Manufacture nameplates from 3 ply lamacoid, minimum 3.2 mm thick with 0.8 mm chamfered edges, engraved lettering and gloss finish.

.2 Use capitalized lettering centred on each row and in Gothic font, sans serif.

.3 Use self-adhesive backing filling the entire area of the back for nameplates except where insufficient area exists to reliably affix a nameplate. For nameplates without self-adhesive backing provide nameplate with 5 mm diameter tie hole.

.2 Use self-adhesive backing, type 3M™ Adhesive Transfer Tape 467MPF or Tesafix 4970 where a nameplate is affixed to a smooth surface.

.3 Use self-adhesive backing, type 3M™ Double Coated Vinyl Foam Tape 4432 at least 0.8 mm thick where a nameplate is affixed to a non-smooth or an irregular surface.

.4 Do not use embossed plastic labels.

.5 Colour coding:

.1 General Purpose - white face, black lettering (outer two plies white, inner ply black), gloss finish.

.2 Essential Electrical Circuits - white face, red lettering (outer two plies white, inner ply red).

.3 Warning Messages - red face, white lettering (outer two plies red, inner ply white).

.6 Nameplate types are designated Type 1, Type 2A / 2B, Type 3 or Type 4.

.7 Nameplate types

Nameplate Type	**Size, mm (H x W)**
Type 1	25 x 90
Type 2A	75 x 180
Type 2B	40 x 90

.8 Nameplate Type 1

.1 Use nameplate Type 1 on all MCC and Switchgear units and compartments.

.2 Conform to The Owner equipment numbering standard for the "Equipment Number".

.3 The inscription is to describe the equipment. Do not exceed three lines for descriptors and do not use hyphens. Place wording logically on each line.

.9 Nameplate Type 2A / 2B

.1 Use nameplate Type 2A for MCC and Switchgear identification and on stand-alone electrical cabinets.

.2 Conform to The District equipment numbering standard for the "Equipment Number".

.3 Type 2B - reduce the size of the nameplate Type 2A by 50 percent (i.e. length and width dimensions to be halved), where nameplate Type 2A is inappropriate for the equipment size.

1.23 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Identify all other wires at each end with indelible Graff-Rite heat shrink tubular markers. Acceptable manufacturer: Graff-Rite Industries Ltd., Port Coquitlam, B.C., or approved equivalent.

.1 Identification numbers shall match full wiring numbers as shown on the Drawings.

.2 Provide wire numbers for all wires and terminals where numbers are not designated on Drawings by using the format "Device tag - terminal number".

.5 Colour code wiring:

.1 600 V AC: Red for Phase A.

.2 Black for Phase B.

.3 Blue for Phase C.

.4 White for Neutral.

.5 120 V AC: Black for Hot.
White for Neutral.

.6 24 V DC: Red for Positive.
(except for loop) Black for Negative.

Loop (analog): White for Positive.

.7 Black for Negative.

1.24 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.25 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

1.26 GENERAL TESTING AND INSPECTION

.1 The equipment shall undergo factory acceptance testing in accordance with this specification.

.2 A factory acceptance Inspection and Test Plan (ITP) shall be submitted for The Owner review and approval. Do not proceed without an approved ITP.

.3 The equipment shall satisfactorily withstand the tests specified.

.4 The records of all tests and all relevant certificates shall be provided as required in the requisition document and these specifications.

.5 Electronic devices shall be completely tested and burned-in before being assembled into the supplied panel or gear.

.6 All factory testing shall be coordinated and scheduled in advance with The Owner, Engineer and Contractor. The Supplier shall give at least two months' notice prior to any test commencement.

.7 The Supplier shall ensure that all required documentation has been collated prior to the final inspection and testing.

.8 Acceptance inspection and testing shall be carried out by the Supplier on the entire assembly and witnessed by The Owner and Engineer.

1.27 FIELD QUALITY CONTROL AND EQUIPMENT TESTING

.1 The Supplier shall provide a factory service representative for participation and supervision of equipment testing and quality control on site.

.2 Furnish manufacturer's certificate or letter confirming that supplied equipment has been installed to manufacturer's instructions.

.3 Include in the tendered price all costs for the attendance of the factory service representative at the site for the times and durations required to fully complete their responsibilities for participation and quality control of the site equipment testing.

1.28 **COORDINATION OF PROTECTIVE DEVICES**

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Overcurrent trip settings for main, tie, and feeder breakers located in the MCCs will be provided by the Engineer.

Part 2 **PRODUCTS**

2.1 **MATERIALS AND WORKMANSHIP**

.1 All materials and equipment to be new, of a current manufacture and free from all defects and imperfections.

.2 Electrical equipment to meet the requirements of this specification, listed codes/standards and rated for continuous operation at full load for the design conditions specified.

.3 All electrical components must be installed in grounded aluminum metal enclosures or grounded stainless steel enclosures as per the applicable CSA standard.

.4 Protective relay instrumentation and controls will be supplied and located in an isolated compartment of the equipment local control panel enclosure. This equipment shall be located on the skid or within the equipment the protective relay instrumentation is intended to protect. Terminal blocks, secondary CT connections, secondary VT connections and miscellaneous control devices shall be located in this isolated compartment. Connection terminal blocks shall be provided for all field wiring and as required for The District's external connections. Operation of the system shall not be affected by opening the compartment doors.

.5 Design and arrange system packages to account for ease of maintenance. Ensure parts and components are easily accessed and removed by maintenance personnel.

.6 Design and arrange electrical equipment to protect personnel against risk of shocks by all available means of interlock, insulation, screens, partitions, enclosures and warning labels.

.7 Provide similar items of equipment and materials from the same Manufacturer. Standardize on products to reduce the number of stocked spare parts.

.8 All equipment shall be CSA approved (or approved equivalent) and will not be shipped to site without confirmation. Any cost of electric inspection dispute related to equipment not meeting CSA approval shall be the responsibility of the Supplier.

.9 Outgoing power connection conductors will be connected to conductor lugs. These terminal blocks will be grouped horizontally near the bottom of the panel, for connection of field wiring by installing contractor. Supplier to provide aluminum, undrilled, removable gland plates for large control panels or equipment junction boxes to facilitate clear direction for installation of field wiring and protection of internals during transportation and installation.

.10 Control conductors will be connected to terminal blocks for field wiring (to external starters, instruments, etc.). These terminal blocks will be grouped together in a logic

manner, for connection of field wiring by installing contractor. Supplier to provide aluminum, undrilled, removable gland plates for control panels or equipment junction boxes to facilitate clear direction for installation of field wiring and protection of internals during transportation and installation.

2.2 ELECTRICAL MOTORS

.1 Provide all motors in accordance with requirements listed in standards; CSA C22.2 No. 100, CSA C22.2 No. 145, and NEMA Standard MG1.

.2 Supplier is responsible to ensure the rating and functional characteristics of the motors match the requirements of the loads.

.3 Motors shall be designed for continuous duty operation at rated power except where the process defines different rated duty type, per the Supplier.

.4 Motors shall have a design life of at least 20 years with periodic maintenance interval of greater than five years and shall be of premium efficient, heavy duty industrial type per NEMA MG1.

.5 Provide motors capable of developing 150 percent of NEMA design B locked rotor and pull-up torques with 100 percent of rated voltage applied and capable of developing in excess of NEMA locked rotor torque values at 90 percent of rated voltage.

.6 Motors shall have sufficient capacity to operate the driven load and associated devices under all conditions of operation without overloading.

.7 Acceptable motor manufacturers are;

- .1 ABB (Baldor / Reliance)
- .2 US Motors (Emerson)
- .3 TECO Westinghouse
- .4 Siemens
- .5 Toshiba

.8 Equipment electrical motor requirements classification:

- .1 Type 1 (General Duty): Unless specified otherwise on data sheet, TEFC enclosures, to NEMA MG1 (Part 30 or 31 based on inverter-duty rating).
- .2 Type 2 (Process): Unless specified otherwise on data sheet, TEFC enclosures, to NEMA MG1 (Part 30 or 31 based on inverter-duty rating), suitable for moist and corrosive environment. All internal surfaces to be coated with an epoxy paint.
- .3 Type 3 (Explosion-proof type): Motors to be TEXP explosion proof rated for operation in a Zone 1, Group IIB hazardous location in accordance with CSA C22.1 (latest edtion). Provide an approved breather/drain device installed in the motor drain hole as allowed by the certification. To NEMA MG1 (Part 30 or 31 based on inverter-duty rating)

.4 Type 4 (submersible applications): Motors to be waterproof with 316SS motor shaft, rated for submerged operation and hazardous area classification. To NEMA MG1 (Part 30 or 31 based on inverter-duty rating)

.9 Motor Insulation

.1 Use Class F insulation

.2 Design motor for temperature rise less than 90°C at 1.15 service factor loading.

.3 Insulation to be non-hygroscopic.

.4 For all motor applications, dip and bake in Class H varnish a minimum of 2 times. For 284T and larger frames, dip and bake a minimum of 3 times.

.10 Current Imbalance

.1 Do not exceed the values tabulated below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system:

.1 Under 37.5 kW: 15 percent

.2 37.5 kW and above: 10 percent

.2 Base imbalance criteria upon the lowest value measured.

.11 Winding Over-temperature Protection

.1 Provide stator winding over-temperature protection on all motors rated 45 kW and larger. Motors rated less than 45 kW to have stator winding over-temperature protection when required by the specific equipment specification section or if recommended by the driven equipment Manufacturer.

.2 Over-temperature protection for motors rated 45 kW and larger and other motors, where specified, to be NEMA MG1-12.53, Type 1, winding running and locked rotor over-temperature protection. One temperature detector shall be provided per phase. Detectors to be positive thermal protection (PTC) thermistor type, with leads brought out to a terminal strip in a NEMA 4x enclosure for Type 2 motors and a NEMA 7C or 9 enclosure for Type 3 motors.

.12 Motor Frame

.1 Use a minimum of grade 25 cast iron, aluminum, or steel for frame, end brackets, fan cover, and conduit box. Refer to motor classifications.

.2 Provide two bronze automatic breather drains at the lowest point in the motor frame.

.3 On frames sizes greater than 180, provide removable lifting eyes at the balance point of the motor, with a design safety factor greater than 10. Vertical motors require two eyes, one on each side of the frame.

.4 Use stainless steel hardware.

.13 Motor enclosures shall be:

Motor Rating	**Enclosure**			
	Non-Hazardous		**Hazardous**	
	Process	**Non-Process**	**Zone 1**	**Zone 2**
0 to 0.75kW	TE	TE or ODP	TEXP	TEXP

Motor Rating	Enclosure			
	Non-Hazardous		Hazardous	
	Process	Non-Process	Zone 1	Zone 2
1 to 186kW	TEFC	TEFC	TEXP	TEFC
> 186 kW	TEFC or WPII	TEFC or WPII	TEXP	TEFC

.14 Motor Terminal Box

.1 Incorporate an oversized terminal box with a volume greater than NEMA requirements, rotatable in 90° increments. Provide gaskets between the terminal box and frame and between the terminal box and cover.

.2 Provide diagonally split, gasketted NEMA 4X terminal boxes complete with threaded hub for conduit entry for ODP and TEFC motors.

.3 Provide adequately sized, diagonally split, gasketted NEMA 7 terminal boxes complete with threaded hub for conduit entry for explosion-proof motors.

.4 Provide a ground connection and lugs in the terminal box.

.5 Provide a separate terminal box for all motors required to have internal monitoring devices c/w terminal blocks.

.15 Motors for Variable Frequency Drives

.1 Select heavy duty, premium efficiency units, inverter duty rated, CSA certified to be in conformance with NEMA MG1, Part 30 and Part 31.

.2 Design to ensure turndown of 5:1 unless specified elsewhere.

.3 Use only Type 2 or Type 3 motors.

.4 Insulation: Class F insulation, suitable for 90°C temperature rise, with a 1.0 safety factor, suitable for moist and corrosive environments and in accordance with NEMA MG1 Part 30 and Part 31. Provide additional treatment at winding end turns to minimize stray current failures. Provide grounding or discharging rings for the motor bearings.

.5 Design motors for variable frequency systems so that they are not required to deliver more than 80 percent of the motor's power rating by any load imposed by the driven machine at any specified operating condition or any condition imposed by the driven machine's performance curve at maximum operating speed.

.6 Ensure motors have adequate cooling capacity when operating through the entire speed range capacity of the drive.

.16 The following voltages are used based on the motor power as follows:

Application	Motor Power Range	Utilization Voltage	Phase
DOL (direct on line)	0.56kW to 75 kW (100 HP)	575 V	3
VFD	0.56kW to 450 kW (600 HP)		
DOL	Less than 0.56 kW (3/4 HP)	120 V	1

2.3 INTERFACE TO STARTERS AND VARIABLE FREQUENCY DRIVES

.1 The Supplier will design for the use of externally mounted motor starting devices (full-voltage non-reversing, full-voltage reversing or VFD) located within a local MCC room.

.2 Supplier shall provide wire termination blocks within a panel or cabinet for connection of all field wiring to the starting devices.

.3 Where control devices are required to be mounted on or in local panels, provide panel or cabinet along with the interface terminal blocks.

.4 The individual drives (supplied by others) will be complete with breaker or fused disconnects, drive, front panel interface module and output dV/dt filter. VFDs will communicate with the Supplier control system by hard wired interface for automatic control.

.5 Input power shall be based on previously defined motor voltages, based on motor sizes.

.6 The Supplier shall be responsible for coordinating the drive and motor characteristics with the installing contractor 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.

2.4 MAIN DISCONNECT

.1 The Supplier shall provide a local main disconnect for each separate power distribution unit included in the Supplier's scope per Canadian Electrical Code requirements.

.2 The main disconnect shall be an unfused safety disconnect switch rated for the maximum full load current of the equipment, located within sight of the equipment and as per the Canadian Electrical Code.

.3 The switch shall provide for padlocking in the open position.

2.5 DISCONNECT SWITCH

.1 Indoor process areas: Non-metallic CSA Enclosure Type 4X, compact, non-fusible, horsepower rated disconnect switch, size as required.

.2 Outdoor Process areas: Stainless steel CSA Enclosure Type 4X, non-fusible, horsepower rated disconnect switch, size as required.

.3 Hazardous Process areas: Non-metallic CSA Enclosure Type 7, non-fusible, horsepower rated disconnect switch, size as required.

.4 Provision for padlocking in on/off position by up to three locks.

.5 Mechanically interlocked door of disconnect to prevent opening when handle in ON position.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

.8 Provide equipment identification in accordance with Section 01 60 12.

2.6 ELECTRICAL PROTECTION AND CONTROL

.1 All circuits fed from packaged control panels, which are part of Supplier's scope, will be protected and controlled by the Supplier.

.2 The Contractor is responsible for installing and wiring all control stations for equipment within packaged equipment scope that are defined as being shipped loose. Supplier to wire and install all control stations for equipment within packaged equipment scope when the mounted point is located on the skid.

.3 All control stations shall be accessible from finished floor or platform whichever is more practical. Power and control devices shall be mounted at 1200mm above finished floor or platform.

2.7 CURRENT TRANSFORMERS (CTS)

.1 One current transformer is to be supplied and installed on each phase, by the Supplier.

.2 Secondary wiring of the current transformers shall be wired to a shorting block installed in the control cabinet of the turbine.

.3 CTs shall have short-circuit rating not less than 40kA at 4160V. They shall be capable of carrying the rated primary current for a period of one minute with the secondary windings open-circuited as specified in CAN/CSA-C61869-1/2/3standard. CTs must be sized such that they do not saturate at fault levels equivalent to 40kA.

2.8 CONTROL PANELS, CABINETS AND TERMINAL BOXES

.1 Electrical equipment to be mounted inside electrical / mechanical rooms shall have a minimum NEMA 12 rating.

.2 All equipment, not mounted in an electrical or mechanical room, shall be of weatherproof construction, unless specified otherwise, with a minimum NEMA 4X rating.

.3 Construct enclosure from fabricated steel of at least 2mm in thickness or heavy duty aluminum. Outdoor mounted or process area enclosures shall be constructed of stainless steel.

.4 Short circuit rating of industrial control panels to be a minimum of 42kA, series ratings of equipment within the control panels is permitted.

.5 The enclosure surface treatment, with exception of stainless steel, shall be painted with protective coating, color ASA61 Grey.

.6 The height of the enclosure shall not exceed 2,400 mm.

.7 All enclosures shall be equipped with SS hinged doors and hardware. The door shall be electrically bonded to the enclosure and hinged to open at least 120 degrees.

.8 Equipment intended to be accessed by the operator shall only be mounted on the front of the enclosure.

.9 Provide main power disconnect switch with fuses or a circuit breaker appropriately rated for the panel loads. Equip disconnects with a lock-off device suitable for padlocking.

.10 Each control panel and control cabinet to include LED lighting and a light switch within the control panel enclosure.

.11 Design circuits for easy fault finding, with isolation for servicing. It shall be possible to replace any device or apparatus without exposure to energized busbars or the live side of any main switch or isolator, and without removal or dismantling of other equipment.

.12 Provide all the necessary termination boxes for interfacing field wiring.

.13 Submit termination box details for approval. Ensure boxes are adequately rated and sized to accommodate field wiring terminal blocks.

2.9 PANELBOARDS

.1 If required within the design and supply of the proponent, panelboards may be installed on the electrical skid equipment is terminated to this board by the factory.

- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .3 Allow for area class requirements in this specification.
- .4 Allow for off-skid power feeders to directly wire to the panelboard(s).

.2 600 V panelboards: bus and breakers rated for 35000 A symmetrical interrupting capacity or as indicated.

.3 250 V panelboards: bus and breakers rated for 10000 A symmetrical interrupting capacity or as indicated.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Two keys for each panelboard and key panelboards alike.

.7 Tin plated copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

.11 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation for panelboards.

.12 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.13 Nameplate for each panelboard type 1 engraved as indicated in Technical Specification 01180.

.14 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.10 GROUNDING AND BONDING

.1 Intrinsically safe (IS) circuits to have separate grounding circuits insulated from the panel.

.2 An instrument ground to be fitted and be insulated from the panel.

.3 Common ground bars to be connected to a ground point near the gland plate, as well as all metal parts of the panel including doors and handles.

.4 Braided ground strap to be installed for all doors and handles.

.5 Internal ground wiring to be stranded copper with 600 V, green/yellow PVC V75 sheathing.

2.11 POWER SUPPLIES

.1 Where packaged equipment contains components which require dedicated power supplies, power supplies shall be provided as part of the Supplier’s package.

.2 The heating effect of power supplies shall be considered when calculating the overall heat load of the enclosure.

2.12 CABLE TRAY

.1 Not included in this supply package.

2.13 CABLING AND TERMINATION

.1 Each alarm, instrument and control device shall be wired back to terminal blocks mounted in the Supplier’s control panel.

.2 Provide 20% spare volume capacity when sizing control panels and distribution boards.

.3 Provide control cables with a minimum of 20% spare cores.

.4 Run wiring in slotted wiring ducts fitted with snap on lids. Do not fill ducts to more than 75% of full wiring capacity. Where ducts are mounted upside down support wiring to prevent the duct lid being forced open by the weight of wiring.

.5 Where wiring ducts are not practicable, wiring shall be in looms using cable ties at suitable intervals.

.6 Segregate different voltages (AC, DC) and instrumentation circuits.

.7 Provide pressure type terminals and marking strips.

.8 Group terminal blocks according to instruments, control and voltage levels.

.9 Provide shorting type terminals for CT secondary wiring.

.10 Except for outgoing connection terminal blocks for wiring to The District's equipment, no more than two conductors to be terminated on any one side of a terminal. If there is a requirement for more than two conductors, terminals with jumper pins shall be used.

.11 No more than one wire to be connected to a terminal designated for external wiring.

.12 Wiring colour codes to comply with the following:

Cable / Wire Function		**At Supply Label**	**At Equipment Label**	**Colour**
LV AC supplies	Phase	A	U	Red
	Phase	B	V	Black
	Phase	C	W	Blue
	Neutral	N	N	White
	Ground	PE	PE	Green
Control AC supplies	Active	L1	L1	Black
	Neutral	N	N	White
	Ground	PE	PE	Green
DC supplies	Positive	+	+	Red
	Negative	-	-	Black
Instrument loop signals	Positive	+	+	Black
	Negative	-	-	White
	Ground	PE	PE	Green / Yellow striped

.13 All terminals are to be numbered in accordance with wiring diagrams.

.14 Outgoing power connections to be connected to terminal blocks for connection by others are to be grouped horizontally near the bottom of the panel. Provide aluminum, undrilled, removable gland plates for large control panels or equipment junction boxes.

.15 Provide ferrules on each end of all wires for control.

.16 Provide numbered wire markers on each end of all wires with designations shown on design drawings. Wires to be of slip on and heat shrink type, with white insulating material and have black numerals. Reference Specification 01 60 12.

.17 Instrument intrinsic cable to be black sheathed with blue marking stripe as per ANSI/IEC standards.

.18 All conductors to be stranded, 98% conductivity copper, with 600V RW90 XLPE insulation, unless specified below. No aluminum conductor permitted.

.19 Branch Circuit Wiring: conductors smaller than No. 12 AWG not permitted for 120 Volt lighting, power or motor branch circuits.

.20 BX cable is not permitted.

.21 Teck Cable

.1 Cable: to CAN/CSA-C22.2 No. 131 Type Teck 90 Cable and No. 174 – Cable and Cable Glands for Use in Hazardous Areas .

.2 Conductors: sized as per Canadian Electrical Code.

.3 Grounding conductor: copper.

.4 Circuit conductor: copper, size as indicated.

.5 Insulation Type: Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.6 Inner jacket: polyvinyl chloride material.

.7 Armour: interlocking aluminum.

.8 Overall covering: thermoplastic polyvinyl chloride material, fire retardant rated and marked as FT4.

.9 Fastenings: One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.10 Channel type supports for two or more cables at 1.5 mm centers.

.11 Threaded rods: 6 mm diameter to support suspended channels.

.12 Wire rope: to support suspended channels.

.13 Connectors: Watertight approved for TECK cable in non-hazardous and corrosive areas, and putty type explosion proof seals in hazardous locations.

.14 TECK cable to be HL rated in hazardous locations.

.22 Drive (VFD) Teck Cable:

.1 To CSA C22.2 No. 123 – Metal Sheathed Cable.

.2 To CSA C22.2 No. 174 – Cable and Cable Glands for Use in Hazardous Areas.

.3 CSA-designated TECK90XLPE cable, CSA-approved for open wiring, concealed or buried, and for use in Zone 1 and Zone 2 hazardous locations.

.4 Vendor certified for VFD – drive connection to electrical motor constructed to provide a low resistance path to ground to reduce the effect of standing and common mode voltage.

.5 Conductors:

.1 Grounding conductor: three x Copper.

.2 Circuit conductors: Copper, size as per the Canadian Electrical Code.

.6 Insulation:

.1 1000 V chemically cross-linked thermosetting polyethylene rated type RW90.

.2 Sheath: continuous aluminum.

.3 Overall covering: Flame-retardant PVC jacket to CSA FT4.

.4 Product equal to Nexans DriveRx VFD.

.23 Instrumentation and Control Wiring

.1 Instrumentation wiring installed in conduit to be twisted pair shielded cables #16 AWG copper conductors minimum, 300 Volt insulation, 100% coverage aluminum mylar shield, bare tinned copper drain wire #16 AWG minimum with overall flame retardant PVC jacket.

.2 Where multi-conductor twisted pair shielded cables are installed on cable tray, each pair shall be individually shielded, and the cable assembly shall have an overall shield with an inner PVC jacket, aluminum armor and outer PVC flame retardant jacket rated 600 Volt.

.3 Control wiring to be type TR-64, #16 AWG tinned copper conductor.

.24 Hazardous Area Wiring and Fittings

.1 Where a process area is classified as hazardous as indicated on the drawings, requiring explosion-proof fittings, the following copper free aluminum (Crouse Hinds option suffix code –SA) equipment shall be installed:

.1 Breather-drains, to prevent condensation in conduit systems, Crouse-Hinds Type ECD.

.2 Conduit seals – Crouse-Hinds Type EYS or EZS.

.3 Conduit drain seals – Course-Hinds Type.

.4 Conduit unions – Crouse-Hinds Type UNY.

.5 Fittings – Crouse-Hinds Type LBY, LBH, GUA, and GUB complete with corrosion-free Epoxy Powder Coating.

.6 Conduit runs – rigid aluminum complete with corrosion-free Epoxy Enamel Coating.

2.14 ANTI-CONDENSATION HEATERS

.1 Anti-condensation heaters rated at 120 VAC will be provided with all motors rated 75 kW and above.

.2 Anti-condensation heaters rated at 120VAC will be provided for control panels and distribution boards located in process areas. Heaters will operate on thermostat or with power down relay.

.3 Operation of these heaters shall be from NC auxiliary contacts of the Supplier's motor starter.

.4 The rating of the heater such as wattage and current drawn shall be specified on the nameplate.

2.15 EQUIPMENT NAMEPLATE

.1 All electrical enclosures, equipment and devices to be identified with nameplates.

.2 Operating handles, meters, control stations, limit switches, proximity switches, sensing elements and other like devices to be provided with nameplates.

.3 Reference Specification 01 60 12 for further direction on nameplate requirements.

Part 3 Execution

3.1 GENERAL

.1 Reference other specification sections for execution of the contract.

3.2 GENERAL TESTING AND INSPECTION

.1 The equipment shall undergo factory acceptance testing in accordance with this specification and The Owner's standard specifications for quality requirements.

.2 A factory acceptance Inspection shall be submitted by the Supplier for review by The Owner and Engineer.

.3 The equipment shall satisfactorily withstand the tests specified below and any additional tests specified.

.4 The records of all tests and all relevant certificates shall be provided as required in the requisition document and this specification.

.5 Electronic devices shall be completely tested and burned-in before being assembled into the supplied panel or gear.

.6 The Supplier shall give two (2) weeks' notice prior to any test commencement unless defined otherwise.

.7 The Owner/Contractor reserves the right to inspect the equipment at the Manufacturer's work site prior to shipping to confirm compliance with specification.

.8 The Manufacturer shall ensure that all required documentation has been collated prior to the final inspection and testing.

.9 Acceptance inspection and testing shall be carried out on the entire assembly unless previously agreed by the Engineer and The Owner.

.10 The Supplier to make available power supplies, tools and skilled labour to enable the final inspection and test to proceed without undue delays.

3.3 CONDUITS, FASTENINGS AND CONDUIT FITTINGS

.1 Provide all aluminum conduit entering or leaving hazardous areas and equipment with Crouse-Hinds Type EYS-SA or EZS-SA copper free aluminum fittings to seal in accordance with applicable code rules and as shown on the drawings. Normally, the seal shall be adjacent to the equipment, but in the case of equipment that may be removed or maintained, such as motors, control stations, switches, receptacles and instruments, a union shall be located between the seal and the equipment. Care shall be exercised to ensure that all seals are made up in accordance with the manufacturer's instructions. Seal in vertical conduits shall be drain-seal type, with a universal breathing-drain installed.

.2 Where conduits penetrate from heated to cold area, seal conduit with approved vapor sealing compound.

3.4 TEST RECORDS

.1 The records of all tests and all relevant certificates shall be provided as required in the requisition documents and this specification.

.2 The test reports shall clearly and unambiguously present all relevant information of the tests. A functional description and definition of specification limits for the acceptance criteria shall be provided by the Supplier and noted in the test report.

3.5 VISUAL INSPECTIONS

.1 The following mechanical and visual inspections shall be performed by the Engineer:

- .1 Quality of workmanship;
- .2 Surface finish;
- .3 Conformity with the approved Shop Drawings and Purchase Orders;
- .4 Conformity and completeness of the data on the nameplate;
- .5 Degree of protection of enclosure;
- .6 Degree of protection within compartments with a view to safety;
- .7 Insulation of the bus-bar system;
- .8 Creepage distances and clearances;
- .9 Correct mounting of components;
- .10 Internal wiring and cabling system;
- .11 Suitability of clamping, grounding and terminating arrangements for incoming, outgoing and auxiliary cables;
- .12 Correct labelling for circuits and interlock systems;
- .13 Grounding system.

.2 The Engineer may request additional tests to verify the integrity of supplied equipment

3.6 FUNCTIONAL TESTING

.1 Main circuits and auxiliary circuits shall be checked to verify compliance with approved schematic circuit diagrams.

.2 When solid-state relays or other electronic devices are fitted, Supplier shall produce evidence that the equipment or individual components have withstood a reliability test, including a 'heat soak' test for an agreed period of time.

.3 Insulation resistance tests shall be carried out between each phase, and neutral against ground, with the remaining phases/neutral connected to ground.

.4 Circuits shall be random tested (with a minimum of 10% of each type) for electrical operation, including the operation of their control and protective devices. Variations in the control supply shall be taken into account.

.5 Thermal relays shall be tested to verify Manufacturer's final factory test results.

.6 Care shall be taken that panel(s) grounds and if applicable, neutral grounding, are appropriate for the connection of restricted or unrestricted ground leakage protection.

.7 Following all the above-mentioned tests the panel(s) and components shall be examined to ascertain whether any components have been damaged and that all parts are in satisfactory operating condition.

.8 Complete records of this inspection and tests, shall be compiled into one inspection document by the Manufacturer and a copy shall be sent to the Engineer for inclusion into the final Supplier's Test Report (MTR).

.9 The Engineer reserves the right to attend other tests which may be agreed upon and to visit the Manufacturer's work site at any time, during normal working hours for inspection of the works.

.10 To facilitate the Engineer's attendance at the acceptance tests, the Supplier shall:

- .1 Give the Engineer a complete detailed program for the tests, four (4) weeks prior to commencement of tests;
- .2 At the same time fully described precise details as to how these tests shall be conducted and documented. Engineer shall approve the tests or direct such changes as are necessary within one (1) week;
- .3 Confirm not less than 48 hours prior to the referenced factory tests that they are scheduled for execution; and
- .4 The Engineer and the Supplier shall agree upon the format of documentation for the tests. They shall in any case be fully documented, related to detailed schematic drawings, and be sufficient to show without question, that the specified tests have been applied to all equipment.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This Section includes, but is not limited to, the furnishing of all materials, labour, equipment and services necessary for the shipment, protection and storage of the Goods.

.2 This section shall be in accordance with Section 00 10 00.

.3 This section supplements recommendations or requirements from suppliers, manufacturers and information provided elsewhere in the Specifications for the shipment, protection and storage of the Goods.

1.2 CARE

.1 Package, ship, handle and store the Goods to prevent damage.

.2 Damaged items will not be permitted as part of the Goods except in cases of minor damage(s) that have been repaired to the satisfaction of the District. These minor repairs will be deemed acceptable only upon written confirmation by the District after the repair(s) have been performed.

1.3 SHIPPING DOCUMENTATION

.1 For each scheduled delivery, provide a written Notice of Shipment at least five (5) working days prior to the delivery of the Goods to the Delivery Point.

.2 Each Notice of Shipment shall include legible copies of the approved Shipping Document as specified herein.

.3 Submit a Shipping Document for each shipment.

.1 The Shipping Document shall clearly state the manufacture, contract number, and shipment number.

.2 Where more than one shipment is made, the shipment number shall be “Shipment 1 of XX”, “Shipment 2 of XX”, etc.

.3 Each Shipping Document shall include a detailed packing list and bill of materials indicating weights of package of item(s) and special unloading and handling instructions.

.4 Each item, package, or bundle of material contained on the detailed packing list(s) and bill of materials shall be tagged or marked as identified in the delivery schedule or on the shop drawings.

.5 Complete packing lists and bills of material shall be included with each shipment.

.4 The Shipping Document shall include a description of all packing material such as wood pallets, plastic, Styrofoam, cardboard, or other indicating approximate weights of each material.

.5 Provide written instructions to the District clearly indicating proper handling, protection, and maintenance of the Goods while stored at the Delivery Point.

1.4 TRANSPORTATION

.1 The Supply Contractor shall pay all costs of transportation and insurance of the Goods to the Delivery Point.

.2 The Supply Contractor shall suitably package all materials to facilitate handling and provide protection against damage from moisture, dust, handling, or other cause during transport from the supplier's and/or manufacturer's premises to the Delivery Point, and during storage thereafter.

.3 Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces that are damaged prior to receipt and acceptance of equipment at the Delivery Point shall be repainted by the Supply Contractor to the satisfaction of the District.

.4 Use stiffeners or bracing, where necessary to maintain shapes, and to give rigidity and support to the Goods and/or packaging during transport and storage.

.5 Deliver parts of the Goods in assembled or sub-assembled units to the maximum extent practicable.

.6 The Supply Contractor shall correct any damage in order to conform to the requirements of the Supply Contract before the Goods are stored temporarily or are incorporated into the facilities and pay the costs arising out of dismantling, inspection, repair and reassembly, as applicable.

.7 The Supply Contractor shall be responsible for unloading the equipment and materials, inventorying and the District for inspecting the delivered equipment and materials upon receipt at the Delivery Point.

END OF SECTION

Part 1 General

1.1 INTRODUCTION

.1 This specification outlines the minimum requirements for the design, fabrication, supply, testing and commissioning of Instrumentation and Control (I&C) equipment provided as part of a mechanical or process packaged system to be supplied by a Supplier for the Sooke Screw Conveyor Project at Sooke, British Columbia.

.2 The equipment defined within this specification includes but is not limited to the controls equipment, control panels, instrumentation and tagging standards as required for the packaged system.

.3 The services defined within this specification includes but is not limited to the supply, factory acceptable testing, delivery to site, installation support, testing (lead), commissioning (lead), training (lead) and collection of all support documentation.

.4 This specification is complementary to Equipment Data Sheets, drawings and specifications that may form part of the tender documents.

.5 It shall apply to those items installed on equipment and those items supplied loose by the Supplier.

.6 Refer to specification contained within of common electrical elements (wiring, raceways, power supply, etc.).

1.2 DEFINITIONS

.1 **Contractor**: Site Installation Contractors or General Contractor

.2 **Supplier:** Equipment or Process System material provider or Supply Contractor

.3 **The Owner**: District of Sooke; the end user

.4 **Engineer**: Equipment Specifier

.5 "When specified", "Where specified" or "As specified" shall mean information shown on the accompanying Data Sheets or drawings by the Engineer.

1.3 LANGUAGE AND UNITS

.1 All documentation shall be provided in English.

.2 All units of measurement shall be in Imperial units.

.3 Where a component or piece of equipment is manufactured using the International Systems of Units (SI units), the SI units should be shown as the primary dimensions, with the Imperial equivalent shown in brackets.

1.4 CODES AND STANDARDS

.1 The design and installation of all instruments shall comply with the rules and provisions of the latest editions and amendments of the Standards and Codes of Practice listed below.

Document No.	Standard Title
ASME PTC 19.3,	Temperature Measurement
ASME B 40.100,	Pressure Gauges and Gauge Attachments
ASME B 40.200,	Thermometers, Direct Reading and Remote Reading
ASME Section VIII,	Pressure Vessels, Division I
ASTM E230	Standard Specification and Temperature-Electromotive Force (EMF) Tables of Standardized Thermocouples
ISA-S5.1	Instrument Symbols and Identification
ISA-75.01-1985	(R1995) - Flow Equations for Sizing Control Valves
ISA /ANSI-MC 96.1	Temperature Measurement Thermocouples
ISA 20	Instrument Specification Forms
ISA 75.02,	Control Valve Capacity Test Procedures
ISA 75.04,	Face-to-Face Dimensions for Flangeless Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.08,	Installed Face-to-Face Dimensions for Flanged Clamp or Pinch Valves
ISA 75.08.03	Face-to-Face Dimensions for Socket Weld-End and Screwed-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)
ISA 75.08.04	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (Class 4500)
ISA 75.08.07	Face-to-Face Dimensions for Separable Flanged Globe-Style Control Valves (ANSI Classes 150, 300, and 600)
ISA 75.15	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (ANSI Classes 150, 300, 600, 900, 1500 and 2500)
ISA 75.16	Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (ANSI Classes 900, 1500, and 2500)
ISA 75.22	Face-to-Centreline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (ANSI Classes 150, 300, and 600)
UL 508A	Standard for Industrial Control Panels
NEMA 250	Enclosures for Electrical Equipment
CEC	Canadian Electrical Code (latest edition)
API – RP551	American Petroleum Institute, Process Measurement Instrumentation
ANSI/ISA-7.0	Quality Standard for Instrument Air
ANSI B16.36	Steel Orifice Flanges

.2 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.3 Quality control is in accordance with the applicable International Standards Organization (ISO) standard.

.4 In addition to Codes and Standards listed above, the following requirements shall apply:

.1 All equipment and assemblies shall carry the CSA or equivalent mark approved for use by the local authority having jurisdiction (Safety Authority: Technical Safety BC, or AHJ) with an associated declaration of conformity. Note that the AHJ has a limited list of acceptable certification agencies.

.2 In the event that specific equipment does not bear an acceptable equipment certification, the Supplier shall obtain local review, inspection, approval and labelling by a certification agency such as CSA or equivalent that is acceptable to the authority having jurisdiction.

.3 The Supplier shall pay for all costs for local inspection and any equipment modification as directed by the certification agency to obtain approval.

.4 In case of a conflict between Standards, CSA Standards take precedence in the interpretation of the requirements over other Standards.

.5 The design and construction shall also comply with the requirements of all authorities having jurisdiction over the site for the type of equipment specified herein.

1.5 CONFLICTS BETWEEN DOCUMENTS

.1 Conflicts between referenced documents shall be identified to the Engineer in writing for resolution. In general, the order of precedence is:

.1 Diagrams and Schedules

.2 Specifications (equipment) and Data Sheet

.3 Purchase Order

.4 This specification

.5 Referenced applicable standards

.2 In the event of any conflict between the Purchase Order, Specifications, Codes and Standards or lack of clear definition as to the applicability of any specification or standard, Supplier shall obtain a written clarification from the Owner before proceeding. The Owner's response and / or instructions shall subsequently form part of this Specification.

1.6 SUPPLIER INFORMATION

.1 The Owner's approval of Supplier's drawings and documentation does not in any way relieve the Supplier of his responsibility to meet the above criteria.

.2 The Supplier shall submit sufficient information (pressures, temperatures, flow rates, specific gravities, corrosive conditions, controller set points, alarm set points, ranges, etc.) to permit The Owner to execute the necessary review and checking activities and to develop control narratives, interconnecting diagrams, and shutdown and security circuits.

.3 Supplier shall provide, and The Owner shall review, interface drawings for complete compatibility with Supplier's equipment, interfacing with The Owner's Control System and for safe functioning of the equipment.

1.7 DOCUMENTATION

.1 Document software or programmed logic in a format acceptable to the Owner. Submit format for approval. Relay Logic, both in PDF for review and in the native PLC logic after commissioning is an acceptable format.

.2 Provide drawings / data as referenced in the subsections below.

1.8 P&ID AND FUNCTIONAL DESCRIPTION

.1 Submit a "Piping and Instrumentation Diagram" (P&ID) showing all necessary instrumentation, pipe sizing and valve types. Include controller set points, alarms, shutdowns, PSV, and PCV settings.

.2 Depict instruments in accordance with ISA 5.1 and 5.3 using the assigned instrument tag number and the site standard tagging (available upon request).

.3 Submit a functional description of the system operation, including the control description overview, alarm and operative setpoints, response to abnormal conditions, normal and emergency shutdowns, normal control sequence(s) and start-up to clarify the controls depicted on the P&ID.

1.9 INSTRUMENT DATA SHEETS

.1 Provide an ISA formatted instrument specification sheet (ISA – S20) for each type of instrument proposed. Include normal, maximum, minimum operating conditions, all process data and materials, and a functional description where applicable.

.2 Each data sheet shall include a revision number, date and signature.

1.10 LOCATION DRAWINGS

.1 All field instruments and associated connections to equipment or process shall be shown in their proper locations on the following types of drawings:

.2 Piping Plans and Elevations; and

.3 Location Drawings.

1.11 INSTRUMENT INDEX

.1 Provide a complete Instrument Index that includes all Instruments supplied with the Packaged Equipment. Submit information in an Excel Spreadsheet and include as a minimum the following items:

.1 Tag number;
.2 Service description;
.3 P&ID number;
.4 Piping line information (material, size, commodity);

.5 Manufacturer;
.6 Model;
.7 Part number (complete selection digits, including selected options);
.8 Power supply voltage requirement;
.9 Plan Drawing Reference;
.10 Installation Detail;
.11 Specification;
.12 Setpoint;
.13 Instrument ranges;
.14 Power Supply;
.15 Hazardous Area; and
.16 Calibration range.

1.12 DESIGN CONSIDERATIONS

.1 Supplier shall be fully responsible for furnishing instruments and instrument systems, meeting the following minimum design considerations:

.1 Meets the design requirements of the Packaged Equipment;
.2 Optimum Operation of Process;
.3 Suitable Quality;
.4 Suitable materials and coatings for the environment and conditions;
.5 Availability of support and spare parts;
.6 Reliability and proven technology;
.7 Quality Construction; and
.8 Safe Operability.

.2 Provide sizing calculations (the use of computerized calculations is preferred) for flow devices, thermowell vibration, control valves, regulators, and pressure relief valves.

.3 The Engineer will review all sizing (based on information provided by the Supplier) prior to the Supplier purchasing the instrument. Review by the Engineer does not waive the Supplier's responsibility for suitable and safe design.

.4 Supply panel drawings for all panels supplied as part of the package. The drawings shall show equipment layout, dimensions, wiring, a bill of materials and tubing details. See Control Panels section below.

.5 Ensure that all instrumentation provided, that is directly wetted by process or utility fluids and is subject to pressure has a valid Pressure Registration Number.

.6 Provide instrument air usage requirements in m3/hr for each device requiring air. Use volume of air for a complete valve stroke closed to open.

.7 Provide standard catalogue data (including technical specifications, wiring details, and instructions for maintenance, operation, and installation) for all instrumentation provided. Highlight information relevant to the actual instrument being used.

.8 Supplier graphics and Control Objects functionality to comply with The Owner's standards (will be provided on request).

1.13 INSTRUMENT NUMBER AND TAGGING

.1 Label all field instruments with a 25 x 50 mm rectangular stainless steel labels stamped with the assigned tag numbers (6 mm high lettering). The Supplier shall affix the label to the instrument with drive pins or stainless steel wire in such a manner that it need not be removed for installation of the instrument.

.2 Label all panel mounted instruments with two lamacoid nameplates engraved with the assigned tag number. Fix one label to the front of the panel and the second on the backside of the panel door.

.3 Label all interior panel components with a lamacoid nameplate.

.4 Follow Owner standards (available upon request).

.5 Wire numbering: Consistent with nomenclature used in available sample drawings.

.6 All PLC I/O module wiring: Numbered according to I/O point base/slot/point assignments.

1.14 INSTRUMENTS INSTALLED IN HAZARDOUS AREAS

.1 All instruments and electrical devices that are fully or partially located within a hazardous area shall be suitably rated for the area classification.

.2 Conduit and cabling systems to instruments located in hazardous areas shall be in accordance with the CEC.

1.15 INTRINSIC SAFETY

.1 Intrinsic safety design methods will only be used where standard instrumentation is not available.

.2 Where intrinsically safe instruments are provided the supplier shall also provide a suitably intrinsic safety barrier. The complete system shall be approved as providing an intrinsically safe method of protection.

1.16 ACCEPTABLE MANUFACTURERS

.1 Where the equipment Supplier is not providing an independent Integrated Control System (ICS) with the Supplier's equipment, The Owner will determine the structure of the control system and the provider of the control system. The equipment Supplier is required to integrate this system into his equipment. Integration includes providing drawings,

documentation and any engineering assistance to The Owner's control system Supplier to allow for this integration.

.2 Provide instruments from those manufacturers listed on the preferred Supplier list in **Part 4**. Where a choice has been provided the Supplier shall source from the preferred manufacturer and if the functionality cannot be met then the Supplier will choose from the alternate manufacturer(s). The Supplier shall notify The Owner if a particular instrument type is not listed and request a list of preferred manufactures for that specific instrument type or measurement application. The Owner will review and approve any new manufacturers and append them to this list. The Owner is not obligated to provide an explanation if a particular product is rejected.

1.17 SUPPLIER RESPONSIBILITY

.1 The Supplier is responsible for the functionality and suitability of all equipment provided as a part of their scope supply, including equipment that is shipped loose for connection to the packaged system equipment.

1.18 SUPPLIER SCOPE

.1 Supply all instrumentation and control devices required to operate the package systems that either mounts directly on the equipment or is field installed and wired to the systems.

.2 Prewire all field mounted instruments and devices to terminals in NEMA 4X junction boxes.

.3 Make provisions in the packaged control systems to interface to the plant PLC system as defined in the equipment specification. Define the provisions for interfacing with external control systems. Details to include the method of communicating all signals including any applicable protocols and all recommend data points for safety and process control/monitoring.

.4 Provide onsite support to lead integration efforts of the equipment; this effort will coordinate with the site Contractor and The Owner.

.5 Provide a testing program and site services to implement the testing of the control system (dry and wet) with the Contractor and The Owner.

.6 Provide a commissioning program and site services to implement the commissioning program of the system with the Contractor and The Owner.

.7 Provide training material, trainer, and allow six training sessions for operations staff (4 hours per session, three in total) and maintenance staff (4 hours per session, three in total). A classroom environment will be provided for the operations staff. Hands on training to be included in part of each sessions.

1.19 **MATERIALS**

.1 Instruments shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.20 **ELECTRICAL APPROVALS**

.1 Provide instruments and control devices rated for the area classification where the devices are to be installed.

.2 CSA labelling for all Control Panels, both fabricated in a shop and modified in the field during construction.

1.21 **RFI PROTECTION**

.1 Provide RFI protection of electronic devices in order to not exceed 0.1% full-scale error at one meter from a 5-watt 2-way radio for frequencies of 20-1000 MHz.

.2 All field mounted devices shall have adequate surge and transient protection.

1.22 **SUBMITTALS**

.1 Meet requirements of submittal package detailed as part of this overall submission.

.2 Include the following:

.1 Power distribution wiring diagram.
.2 PLC wiring diagrams including all I/O points.
.3 PLC code (PDF).
.4 Communication and remote I/O interface module wiring diagrams.
.5 Operator interface terminal (OIT) wiring diagram if applicable.
.6 Back panel and subpanel layouts showing location of panel-mounted equipment.
.7 Enclosure elevation drawing showing location of externally mounted equipment.
.8 Enclosure assembly diagram if applicable.
.9 Complete bill of materials.
.10 Equipment details for each component.

Part 2 **Products**

2.1 **DESCRIPTION**

.1 Equipment to be hard wired interface for primary control (start/stop, run and common alarm status) and Ethernet/IP for secondary feedback (system specific alarms).

.2 Supply products modified as necessary by the manufacturer to provide the specified features and to meet specified operating conditions.

2.2 MATERIALS AND WORKMANSHIP

.1 All materials and equipment shall be new, of current manufacture and free from all defects and imperfections.

.2 Measurement and control devices in contact with the process medium shall be 316SS (stainless steel), except as otherwise noted in this specification. If stainless steel is not compatible with the process medium the supplier shall identify the deviation and propose an alternate material.

.3 Body material of all in-line devices shall be equal or superior to the vessel/piping material to which they are connected (i.e., pressure / temperature ratings, chemical compatibility, etc).

2.3 INSTRUMENT ELECTRICAL REQUIREMENTS

.1 All instruments to be watertight with conduit drains at low points, rated NEMA 4X (IP66).

2.4 INSTRUMENT WIRING

.1 Refer to General Electrical Requirements specifications of common electrical elements (wiring, raceways, power supply, etc) for instrumentation and control devices.

.2 Wire sizes and cable types used for instrumentation and control devices are as follows:

.1 16 AWG, 7 strand, twisted concentric tinned copper wires shall be used for single pair and single triad conductors, wired with mylar tape shield.

.2 18 AWG, 7 strand, twisted concentric tinned copper wire shall be used for multi-pair and multi-triad conductors, wired with mylar tape shield.

.3 PVC insulation, 75°C to -40°C handling, rated at 300V and in accordance with section 4 of CSA-C22.2 shall be used.

.4 Shielding shall be 100% coverage by an aluminum-Mylar tape shield and drain wire. Drain wire shall be 18 AWG on single pair and single triad wires and 20 AWG on multi-pair and multi-triad wire. The aluminum-Mylar tape shall be in contact with the drain wire at all times.

.5 Multi-wire conductor cables shall have each pair or triad shielded, insulated and with a drain wire. Each cable shall have an overall shield and drain wire.

.3 Wiring and cabling shall be permanently identified with the instrument tag number and marked at junctions and terminals. Wiring on an equipment skid shall be terminated in a junction box. Junction box shall be located at skid edge. Individual conductors and drain wires shall be splice free from terminal to terminal.

.4 The signal wire colour code shown below is intended to apply to all wiring, including the Device Cable, the Home Run Cable and Panel Room internal wiring. The number in brackets indicates the Wire Subscript to be used where single conductors are used and the colour code cannot be applied.

.5 RTD extension wire shall be triads with aluminized shield tape and tinned copper drain wire.

.6 Wiring for different systems shall not share the same cables, terminal boxes or conduit. Supplier shall provide segregated terminal strips in local panels. The following systems shall be separated from each other:

.1 120/220 V AC supply circuit

.2 Low voltage instruments signals

2.5 WIRING COLOR CODING

.1 Color coding of instrumentation wiring is listed in the following table:

		Supply Label	Equipment Label	Wire Color
Control AC supplies	Power	H	BLK	Black (-1)
	Neutral	N	WHT	White (-2)
	Ground	G	GRN	Green
AC Controlled by Relay	Signal	S	RED	Red
DC supplies	Positive	+	BLU	Blue
	Negative	-	BLU/WHT	Blue w/ White Stripe
DC Controlled	Signal	S	BLU	Blue
Instrument signals 4-20 mA	Positive	+	RED	Red
	Negative	-	BLK	Black
	Signal und	SG	SG	Silver
Ethernet	Jacket			Yellow
HART (2 pair)	Jacket			Blue
	Positive Pr #1	+	BLU/WHT	Blue/White
	Negative Pr #1	-	WHT/BLU	White/Blue
	Positive Pr #2	+	ORG/WHT	Orange/White
	Negative Pr #2	-	WHT/ORG	White/Orange
Fibre Optic	Jacket		WHT	Orange

2.6 SIGNAL LEVELS

.1 Pneumatic signals shall be 3 – 15 PSI(g) or 5-30 kPa(g).

.2 Analog instrument and control device signals shall be 4-20 mA DC with HART protocol.

.3 Analog instrument and control device signals between packaged equipment and the plant control system shall be 4-20 mA DC.

.4 It is preferred that all instruments are loop powered when suitable instruments are available. If external power is required, the preference is 120 VAC. External power requirements shall be communicated to The Owner.

.5 Discrete signals such as switches and solenoids shall operate at 120 VAC and be powered through the control system. The preference is for FORM-C dry contacts with wetted voltage derived from the input device.

.6 Discrete Control shall operate at 120VAC and be powered through the control system. DC voltage will be allowed where applicable; ensure signals of different voltages are not run in common conduit (included those with high insulation ratings).

.7 Solenoids shall be 'low power' type, 4 watts or less.

.8 Communication between Supplier's PLC and the plant PLC system will be by Ethernet based communications using Ethernet/IP protocols.

2.7 TRANSMITTERS

.1 Transmitters shall be equipped with LED or LCD backlit integral indicators.

.2 Process variable switches (low, high switch points) to be provided as programmable adjustable variables based on analog inputs\variables in the PLC. Minimize the use of standalone process alarm relays.

.3 Switches, where unavoidable, shall be single pole, double throw, hermetically sealed. Applications calling for both alarm and shutdown shall be separate switches in separate housings and have separate connections and isolation manifold to sensing point.

.4 All switches and relays shall have contact ratings of at least 120 VAC 0.5 amps. Shutdown output signals for solenoid valves shall be rated for 120 VAC, 2 amp loads.

.5 Electric interlock circuits shall be normally energized and use contacts opening to cause a shutdown. For alarm indication use normally open contacts that close on alarm.

2.8 WINTERIZATION

.1 Field mounted instruments, such as transmitters, gauges, etc., which are not suitable for use at -40°C shall be protected with a pre-molded instrument enclosure meeting the following requirements.

.2 The enclosure shall have a latchable cover and if the instrument is of the indicating type, a window where the indicator is visible through the window.

.3 Also a lamacoid label shall be affixed to the outside of the enclosure with the instrument tag clearly visible.

.4 An electric heater and thermostat shall maintain a minimum temperature of 10°C inside the enclosure.

.5 Where impulse tubing is located outside and is prone to freezing, prefabricated, heat-traced and insulated tube bundle shall be used.

2.9 INSTRUMENT AIR SUPPLY

.1 The maximum number of users downstream shall determine the instrument air header line size, including 20% spare. The chart below states the size of the header versus the number of users.

.2 Air Header Size and Number of Users:

.1 12 mm (1/2 inch NPS) maximum 4 users

.2 19 mm (3/4 inch NPS) maximum 10 users

.3 25 mm (1 inch NPS) maximum 25 users

.4 40 mm (1-1/2 inch NPS) maximum 80 users

.3 Provide a single point of connection for instrument air for each skid. From this point, an air header shall be run around the skid. Individual take offs will be run to within 24 inch of every instrument and include an isolation valve at the instrument. Each take-off from the header is to have an isolation valve.

.4 Every instrument requiring instrument air at a lower pressure than 120 PSI(g) to have its own filtered pressure regulator. If the Supplier prefers to use a single regulator to serve multiple users via a header, this regulator shall be dual redundant with individual isolation. In case of a common regulator, a pressure gauge and a relief valve are required on the low-pressure header.

.5 The main air header shall contain two pressure regulators in parallel, complete with parallel filters, a 114 mm (4½") pressure gauge with block valves but no bypass, and with a relief valve. The regulators and filters shall be valved so that one may be removed without interrupting service to the panel.

.6 Tubing to each instrument which is not equipped with a self-sealing disconnect valve shall be provided with a block valve and test tee for calibration purposes.

.7 Process leads to pressure instruments – 12 mm (½" OD) x 1.2mm (0.049" W.T.) 316 SS seamless tubing shall be used with Swagelok 316 SS fittings. Special materials may be required depending upon process conditions.

.8 Instrument air signal tubing shall be 6mm (¼" OD) x 0.8 mm (0.035" W.T.) 316 SS seamless with Swagelok fittings. Where instrument in question is subject to frequent maintenance or high vibration, vibration loops may be used or alternate tubing (e.g. Flexible armoured Teflon or Multi-Purpose hose such as Swagelok PB Series Push-On multi-Purpose Hose).

2.10 UNITS OF MEASUREMENT

.1 All engineering units used on the project shall be in Standard US units unless otherwise specified. This will apply to all calculations, drawings, data sheets, etc.

2.11 PRESSURE

.1 All pressure instruments shall be provided with a 19 mm (¾" NPT) x 12mm (½" NPT) isolation valve.

.2 Pressure instruments in steam service shall be provided with a 12mm (1/2 inch NPS), ANSI CL 800, globe type isolation valve with socketweld inlet connection and FNPT outlet connection.

.3 Each gauge or absolute pressure device shall be equipped with a two-valve manifold. Each differential pressure device shall be equipped with a five-valve manifold.

.4 Primary pressure elements shall be 316 stainless steel minimum for all pressure instruments, unless conditions of service require otherwise. Pressure containing parts constructed from aluminum shall not be used.

.5 For dirty, solidifying or corrosive process fluids, pressure instruments shall be equipped with a 75 mm (3 inch NPS) flanged diaphragm seal, rated to withstand the corrosive nature and temperatures of the process. A full port isolation valve and flushing connections shall be provided for each diaphragm seal.

.6 Local pressure gauges shall be installed to verify the functionality of the following instruments and equipment:

- .1 Relief valves
- .2 Regulators
- .3 Pressure transmitters
- .4 Pump suction and discharge
- .5 Exchanger nozzles
- .6 Other equipment as necessary

.7 Local pressure gauges for process services shall meet ASME B40.100. Further specifications shall be as follows:

.8 Gauge Design:

- .1 Minimum 115 mm (4.5") diameter
- .2 Solid front with blow-out back construction
- .3 Acceptable case materials – stainless steel or phenolic
- .4 White dial with black numerals and linear scale
- .5 Micrometer screw for pointer zero adjustment
- .6 Bourdon tube, tip and socket material shall be 316 SS
- .7 Gauges shall have a 12mm (½" NPT), male, bottom connection
- .8 As a minimum, gauges in pulsating or vibrating service shall be filled with Dow Corning 200 fluid
- .9 Gauges used in steam service shall be supplied with steam siphon to protect the gauge from heat damage.

.10 Movements shall be constructed of stainless steel. Movements shall be of the quadrant and pinion design or the helicoid arm and roller design.

.11 Gauge accuracy shall be 1% or better maximum scale reading. Repeatability shall be better than 0.5% of maximum scale reading. Gauges will be selected such that the normal process pressure falls between 30% and 70% of scale.

.12 Gauges shall be provided to withstand a pressure of up to 1.3 times the scale range. Gauge range shall exceed the set pressure of any related pressure relief device.

.13 Diaphragm seals shall be used for winterizing pressure gauges and corrosive services. Extended diaphragm seals can be used where there is a possibility of set up or to minimize fluid outside the pipeline. Material for diaphragm seals shall be compatible with the process fluids.

.14 Process gauges for low pressure application shall be as described in the preceding except that they shall have diaphragm sensing elements.

.15 Pressure gauge connections on vessels shall be flanged.

.16 Pressure gauge connections associated with heat exchangers shall be on the piping, not on the exchanger nozzles.

.17 In addition to the piping supplied isolation valve, each pressure gauge shall have a block and bleed calibration valve.

.18 Cooling fins shall be considered to reduce high process temperature effects on the gauges.

.19 Gauges used in service where pressure spikes and vibration are a concern shall be supplied with pressure snubbers.

2.12 DOOR SWITCHES

.1 A mechanical limit switch shall be installed on each exterior door to detect if each individual door is opened. All the contacts are to be wired and connected to inputs of the area PLC.

.2 Switches may be a magnetic type that is sensitive to a ferrous metal target. This alternate device shall be model 11-12110-00 as manufactured by Topworx.

.3 Alternative models from Topworx that are more convenient to mount or have better delivery are acceptable, but switches from other manufacturers are not acceptable. The targets are to be fabricated in the field.

2.13 ON/OFF VALVES

.1 Solenoid valves shall be supplied suitable for the applicable area classification. Coils shall be continuous duty (120 VAC) weatherproof encapsulated type. De-energization of the solenoid valve shall result in the valve moving to the fail safe position. Low wattage solenoids (4 watts or less) shall be utilized. Inline solenoid valves shall not be installed in lines larger than 25mm (1 inch NPS).

.2 On/off valves shall be specified as line size, full port, or reduced port depending on the process flow rate.

.3 Valves shall have Open/Closed position feedback. Where electrically operated valves are utilized they shall have both Remote / Local operation with status feedback and position feedback.

.4 Actuators shall be sized for 1.3 times the valve's maximum break-out torque at full rated ANSI differential pressure, and at the minimum instrument air supply pressure as specified on the project site data form. Motorized valves may alternatively be supplied with approval of the Engineer.

.5 On/Off valve body materials, including bolting shall be as per the corresponding piping class. Valve bodies shall have pressure—temperature ratings equal to or greater than the flange rating of the lines in which they are installed.

.6 Depressurizing valves shall be single seat globe-style valves if suitable for the service.

.7 Ball valves shall be of the bolted body design.

.8 As a minimum, inner valve trim shall be stainless steel.

.9 The finish on the flange contact face shall be specified the same as the matching pipe class.

.10 Control functions shall not be combined in a single valve with emergency shutdown and/or depressurizing functions.

.11 Actuators for Emergency Shutdown (ESD) valves shall be designed such that the valve fails in the chosen position whenever the motive force or signal is lost. The only exception will be motor-operated valves; these require Engineer’s approval.

.12 Emergency shut-off valves shall close within the time dictated by the process conditions, but in any case, in less than one second per inch of line size. Pipeline shut-off valves require different stroking speed to prevent severe hydraulic pulsations, which can damage equipment.

.13 Test documentation shall reference tag number.

2.14 MOISTURE DETECTION

.1 Provide moisture detection as required and to meet local code requirements.

2.15 CONTROL PANELS

.1 Local control panels associated with package units shall be designed and supplied by the Supplier. Front of panel layout, panel interior layout, and electrical wiring and/or tubing schematic drawings shall be submitted to the Engineer for approval. The Engineer approval shall be obtained prior to commencing work. Review by the Engineer does not waive the Supplier’s responsibility for suitable and safe design.

.2 Panels shall be of welded steel construction, framed, and braced with angle or channel steel as necessary.

.3 Cabinet will house an LED light, convenience receptacle and Print Pocket. All cabinets to be labelled per site standards.

.4 Doors shall be complete with piano hinge. Hinged doors shall utilize three-point, heavy duty latches. Doors shall be easily removable if not used for mounting of equipment. Panels to be mounted outdoors shall be provided with strip heaters and thermostatic controls, with power being fed from a separate external circuit. Panels shall have all cable entering from the side or bottom. If an outdoor panel is furnished with LED or LCD displays, the Supplier shall provide a sun screen to avoid direct sunlight on the panel face.

.5 Provide manufactures standard finish. Where special colors are required sandblast panels and then paint with two coats of primer prior and finish paint color. Use 316 SS unpainted panels in process areas and outdoor locations.

.6 Each panel, which is not permanently mounted by the Supplier on an equipment package, shall be provided with removable lifting lugs designed for lifting without deforming the panels.

.7 Panels and all equipment shall be suitably secured and protected to ensure that it will not be damaged in shipment or storage at the job site.

.8 Panels, including instrument components, electrical wiring, and devices, must conform to the electrical area classification where the panel is installed.

.9 Panel cut-outs and openings shall be gasketed and sealed to provide as minimum NEMA 4X (IP66) panel enclosure rating.

.10 Internal panel wiring shall utilize smooth, rigid, vinyl wireways as manufactured by Panduit. The wireways shall have removable closed top and slotted sides and be coloured White for DC voltages, and Grey for AC voltages. The wireways shall be limited to 50% capacity by cross-sectional area. All wiring shall be properly secured in wireways by the use of cable ties. Mixing of AC and DC wiring within the wireways is unacceptable.

.11 All signals and spare I/O shall be wired out to the terminal strips. Terminal blocks shall utilize DIN rail mounted single level terminal blocks, complete with fuse disconnect for power connections and knife gate disconnect for signal connections. Wiring terminating within these types of terminal blocks shall be connected without the use of crimp connections.

2.16 **CONTROL SYSTEM REQUIREMENTS**

.1 Process Control

.1 The District of Sooke utilizes a PLC/SCADA architecture based on Allen Bradley PLCs and iFIX 5.8 SCADA. The SCADA is used as the primary operator interface to monitor and control the entire plant. The SCADA will monitor and control the packaged system. In addition, it collects and provides historical plant information. It is intended that the conveyor processes are marshaled to common areas of the

supplied skid, with detailed wiring and control narratives to be provided, allowing integration into the site control system.

.2 Where a Programmable Logic Controller (PLC) is provided for the package control system, it shall be supplied in accordance with the following requirements:

.1 The PLC rack shall include power supply unit, processor and I/O. Multiple racks may be used, but the system, when commissioned, shall include 20% installed spare I/O and 10% spare slots.

.2 A complete listing of all PLC hardware shall be provided.

.3 A copy of the programmed logic in native file format and printed or PDF copy of the PLC program shall be provided. Password to access machine level programming shall be provided to The Owner.

.4 The PLC make and model shall be Allen Bradley, Compact Logix-based. Individual components shall be chosen by the Supplier. Card types shall be standardized. Supplier shall provide a Bill of Material (BOM) as a shop drawing.

.3 Provide programming information as a detailed written description and/or Cause and Effect Diagram (C&E) showing the operating sequence and interlocks. Descriptions shall include tag numbers, operating parameters, set points, and start-up AND shutdown procedures.

.4 An HMI (minimum 12” dimension) will be provided to allow operation of the control system locally.

.5 120 VAC Discrete Inputs: The control panel will provide 120VAC to field equipment for signaling purposes only.

.1 Wires: Red.

.2 Field equipment: Equipped with 120VAC rated dry contacts and will operate the dry contacts. All Emergency Stop and other alarm Inputs shall be wired Failed-Safe (normally closed), where the de-energized circuit represents an alarm.

.3 For each dry contact, a pair of wires shall be installed and landed from the panel to the dry contact.

.4 One wire shall be hot (+) the other shall be used to return power back to the when the dry contact is closed.

.5 Both wires shall be continuous home-runs from field equipment panel to panel with NO intermediate terminations or splices.

.6 A sample drawing will be provided and followed.

.6 120 VAC or 24VDC Relay Outputs: The panel will be Supplied with120VAC or 24 VDC control power from the field equipment for control purposes only.

.1 Wires: Yellow to indicate foreign voltage.

.2 Discrete Output card will provide a dry contact to switch power on and off. Each dry contact will only have one function and serve only one piece of field equipment (for example, a single dry contact cannot be used to turn on a pump and used to illuminate a panel light).

.3 For each dry contact, a pair of wires shall be installed and landed from the panel to the field equipment.

.4 One wire shall be hot (+) the other shall be used to return power back to the field equipment when the dry contact is closed.

.5 De-energizing field equipment will consequently de-energize the 120VAC or 24VDC control power.

.6 Both wires: Continuous home-runs from field equipment panel to panel with NO intermediate terminations or splices.

.7 A sample drawing will be provided and followed.

.8 In general, the current for Allen Bradley output modules shall not exceed 2 Amps and never exceed the manufacturer's limitations. The A-B relay output module used on panels does not have on board fusing, therefore one of the 2 terminals provided for field connections, typically the line side, will be equipped with a 2A rated fast blow fuse.

.7 Terminal Approved Manufacturer.

.1 Weidmuller brand or equal.

Terminal Type	Weidmuller Cat. No.
Analog input (+), fused	WSI6
Analog input (-)	WDU2.5
Analog input shield	WPE2.5
Analog output (+)	WDU2.5
Analog output (-)	WDU2.5
Analog output shield	WPE2.5
Discrete input	WDK2.5*
Discrete output	WDU2.5
Digital output, fused	WSI6
All others	WDU2.5 or WSI6

.8 *Note: Discrete input terminal block assemblies require 2-tier terminals. The top tier is used for the individual inputs. The terminals on the bottom tier are ganged together using internal screw jumpers to form a voltage bus for wetting of field contacts.

2.17 PILOT DEVICES

.1 Selector switches, pushbuttons, and indicating lights: Heavy duty, oil-tight, 30mm, NEMA 13-rated.

.2 Selector switches and pushbuttons.

.1 Supplied with operator mechanisms, appropriate number of contact blocks, and any necessary legend plates bearing pertinent information.

.2 Contact block terminals: Labeled for identification purposes and contain no less than one single-pole, double-throw contact.

.3 Contact blocks: Heavy duty type rated for 10A breaking current at 120V.

.3 Stop and emergency stop pushbuttons: Red in color unless otherwise noted.

.4 Other pushbuttons: Black unless otherwise noted.

.1 Pushbuttons.

.2 Operation: Momentary.

.3 Switch operation for local-remote, auto-manual, and computer-manual selection: Maintained in all positions.

.4 Provided with flush head bezels.

.5 The following color code shall be used for the lenses of all indicating lights:

FUNCTION	COLOR	FUNCTION	COLOR
ON	Red	HIGH	Yellow
OFF	Green	AUTOMATIC	White
CLOSED	Green	MANUAL	Blue
OPEN	Red	LOCAL	Blue
LOW	White	REMOTE	White
FAIL	Yellow	POWER ON	White

TRIPPED Yellow

.6 Indicating lights: Push-to-test LED-type, rated for 120V operation.

.7 Selector switches, pushbuttons, and indicating lights: Allen-Bradley Series 800, Siemens Class 52, or equal.

2.18 GENERAL TESTING AND INSPECTION

.1 The equipment shall undergo Factory Acceptance Testing (FAT) in accordance with this specification and The Owner Standard Specifications for Quality Requirements.

.2 Calibration and commissioning work shall be carried out by qualified technicians. The work shall be performed by the manufacturer's service representatives if so required.

.3 Demonstrate instrument calibration and loop checks. Each loop check shall be documented and successfully demonstrated to the Engineer for sign-off.

2.19 INSPECTION AND TESTING

.1 Refer to General Electrical Requirements for specification of Quality Control and Assurance requirements.

.2 Supplier shall perform a control system Site Acceptance Test (SAT) as part of the systems start-up services. Supplier shall provide testing procedure and documentation to be used during system start-up, for approval by The Owner.

Part 3 Execution (See Primary Specification)

Part 4 Preferred Suppliers

4.1 PREFERRED SUPPLIERS LIST

.1 Provide similar types of equipment from the same Supplier.

.2 Provide a list of proposed manufactures for the types of instruments and control devices being provide

.3 Provide equipment from manufacturers listed in the preferred Supplier table below.

Description	Preferred	Alternate
HMI	Allen Bradley PVPlus, minimum 12”	None
PLC	Allen-Bradley – Compact Logix L30 or greater	Allen Bradley MicroLogix 1400 (1766-L32BXBA), (small systems only)

Description	Preferred	Alternate
Control Valves	Emerson(Fisher)	Samson Controls/Flowserve/ Metso (Neles-Jamesbury) / SVF Flow Controls/ DeZurik / Pratt / Milliken / Valmatic / Kennedy
Automatic On/Off Valves	Emerson	DeZurik / Pratt / Milliken / Valmatic / Kennedy Clarkson / Metso (Neles-Jamesbury) / SVF Flow Controls
Analysis	YSI or Hach	Endress + Hauser, ABB / CEM
Level Instruments (non-contact)	Endress + Hauser	(Rosemount)
Level Instruments (non-contact, point)	Endress + Hauser Vicronic Liquiphant FTL50)	Rosemount Vibrating Fork Level Switch 2120
Level Instruments (Style)	Pressure Vessels – Differential Chemical Tanks – Ultrasonic/Microwave Digesters - Microwave	
Level switches	Anchor Scientific P40N0	
Pressure switches	United Electric Controls	Ashcroft / Mid West Instruments / Dwyer-Mercoid
Flow switches (thermal)	Fluid Components International	ABB / Kayden / IFM
Pressure Transmitter (wetwell/similar)	Endress+Hauser (Waterpilot FMX 21)	
Pressure Transmitter (DP, Absolute))	Endress+Hauser (Deltabar PWD 55)	Rosemount (3051, 2051)
Pressure Gauge	Wika	Ashcroft / Weksler
Pressure Regulator	Fisher	Masonelian
Temperature Gauge	Wika	Ashcroft / Weksler
Temperature Transmitter	Endress+Hauser (iTEMP TMT 82)	Rosemount 214C Temperature Sensor w/ transmitter
Damper & Valve Actuators (electric)	Beck or Rotork	Auma / Flowserve
Damper & Valve Actuators (pneumatic)	Flowserve	Rotork / Beck / Numatics
Flow (Liquids) (Magnetic In-Line)	Endress + Hauser (Promag 400)	Rosemount 8750W, 8712E, Sparling Instruments, Bailey-F&P, Foxboro
Flow (Slurry, Sludge) (Non-contacting)	Flex-IM	Endress + Hauser / Emerson (Rosemount
Flow (turbine & Positive Displacement)	Brooks, ABB	Daniels, Flowline, Liquid Controls
Flow Gas	Endress+Hauser (t-mass 65F)	Sage
Combustible Gas	Sensidyne SensAlert ASI	MSA Ultimax XE
Combustible Gas Strobe	Killark SHBG-2-23R (C1D1)	
Indicators (rate / flow)	Dwyer	Beka, Omron, Crompton

Description	Preferred	Alternate
Density	Royce	Berthold / Process Automation (RSA) / Thermo-scientific / Toshiba
Solenoids	Asco	Rexroth / Parker / Festo
CCTV	Diamond Canapower	Canty / Northern Video / Schneider Electric
Warning Siren	Federal Signal	Claxon
Flashing Light (Xenon / LED)	Federal Signal	Edwards
Safety Relief	Farris	Tyco / Anderson Greenwood
Cable / Fibre Optic / Profibus	Belden / Anixter	Corning / Nexans / Optimum Cable Corporation
Terminals (Cabinets)	Weidmuller (W Series)	
UPS	Eaton (Ferrups)	Siemens Sitop
Surge Protection	Weidmuller SD323X	
Selector Switches, etc	Allen Bradley 800T	
Control Relays + Time Delay Relays	Weidmuller WDK	

END OF SECTION

Part 1 **General**

1.1 **GENERAL**

.1 Compile product data and related information as specified in each section appropriate for the Owner's maintenance and operation of products furnished under the Contract using the District's standard template for O&M manuals.

.2 Prepare operating and maintenance data as specified in this Section, and as referenced in other pertinent Sections of the Specifications.

.3 Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

.4 Refer to General Conditions re: holdback until complete compliance with the performance of the Work of this Section.

.5 Submit four sets of operating and maintenance manuals for all equipment valves, pumps and fittings described herein or as requested by the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, electrical inspection authority certificate and contract guarantee.

1.2 **QUALITY ASSURANCE**

.1 Preparation of data shall be done by personnel:

.1 Trained and experienced with knowledge in maintenance and operation of the described products.

.2 Completely familiar with requirements of the Section.

.3 Skilled as a technical writer to the extent required to communicate essential data.

.4 Skilled as a draftsman competent to prepare required drawings.

1.3 **FORM OF SUBMITTALS**

.1 Prepare data in the form of an instructional manual for use for Owner's personnel.

.2 In the format required by the District's standard template for O&M manuals.

.3 Submit two (2) complete copies for review. Once the District's comments have been incorporated, provide two (2) complete copies and an electronic copy. Provide the electronic copy in MS Word format and sections, such as, manufacturer's information may be in PDF format. O&M shall include "As-Constructed" drawings of the completed works provided in AutoCAD format complete with plot style table (CTB file), a DWF file(s) containing all drawings and a reproducible copy to NAD83 UTM coordinates.

.4 Format:

.1 Each system shall be bound in a separate binder.

.2 Size: 215 mm x 280 mm

.3 Cover: Identifying each volume with types of printed title "OPERATIONS AND MAINTENANCE INSTRUCTIONS".

.4 List:

.1 Title of Project

.2 Identity of general subject matter covered in the manual

.5 Binders:

.1 Two D-Ring binders with clear view pockets on front and side for each manual.

.2 Binders to fit 215 mm x 280 mm size paper.

.3 When multiple binders are used, correlate the data into related consistent groupings.

1.4 CONTENT OF MANUAL

.1 Neatly typewritten table of contents for each volume, arranged in systematic order where applicable following specification format.

.1 Contractor, name of responsible principal, address and telephone number.

.2 Names of subcontractors and suppliers.

.3 A list of each product required to be included, indexed to the content and the volume.

.2 Include only those product data sheets pertinent to the specific product. On each sheet clearly identify the data applicable to the installation or delete inapplicable references.

.3 Include the following information plus data specified:

.1 List all equipment which will require regular inspections and servicing.

.2 Maintenance instructions for all equipment and materials.

.4 Drawings: do not use Project Record Drawings as Maintenance Drawings.

.5 Adjusting tools, keys, spare parts: necessary adjusting tools, wrenches, brushes, keys, spares and the like as stipulated shall be provided at no additional cost to the Owner.

.6 Equipment and Systems:

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts;

.2 Panelboard Circuit Directories: provide electrical service characteristics, controls and communications;

.3 Include installed colour coded wiring diagrams;

.4 Operating Procedures: include start-up, break in and routing normal operating instructions and sequences. Include registration, control, stopping, shut-down and emergency instructions. Include any special operating instruction;

.5 Maintenance Requirements: include routine procedures and guide for troubleshooting, disassembly, repair and reassemble instructions; and alignment, adjusting, balancing and checking instructions;

.6 Provide servicing and lubrication schedule, and list of lubricants required;

.7 Include manufacturers printed operation and maintenance instructions;

.8 Include sequence of operation by controls manufacturer;

.9 Provide original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance;

.10 Provide installed control diagrams by controls manufacturer;

.11 Provide Contractor's coordination drawings, with installed colour code piping diagrams;

.12 Provide list of original manufacturer's spare parts, current price and recommended quantities to be maintained in storage;

.13 Include test reports as specified in Section 01400 – Quality Control or other sections;

.14 Additional Requirements: as specified in individual specification sections.

.7 Warranties and Bonds (Per General Conditions Article 34)

.1 Compile specified warranties and bonds;

.2 Co-execute warranty submittals when so specified;

.3 Review submittals to verify compliance with Contract Documents;

.4 Submit to Engineer for review and onward transmittal to the Owner;

.5 Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors;

.6 Number of original copies required: one (1) each.

Part 2 **Products - Not Used**

Part 3 **Execution - Not Used**

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the design, manufacture, supply, factory testing, delivery, and supervision of installation, testing and commissioning of the screw conveyor system, including screw conveyors, inlet hoppers, solids distribution appurtenances, discharge accessories, and other appurtenances, for a complete operational system.

1.2 SYSTEM RESPONSIBILITY

.1 Provide a coordinated and fully integrated system to meet the function and design requirement as detailed herein.

1.3 SUPPLEMENTS

.1 Refer to the Contract drawings depicting the specified screw conveyance system.

1.4 REFERENCE STANDARDS

.1 Conform to the following reference standards:

- .1 ABMA Std. 11, Load Ratings and Fatigue Life for Roller Bearings.
- .2 CEMA 350, Screw Conveyor Dimensional Standards.
- .3 CSA C22.1, Canadian Electrical Code.
- .4 BCBC, British Columbia Building Code.
- .5 AISI, Standard Steels.
- .6 AGMA, American Gear Manufacturers Association.
- .7 ASTM:
  - .1 A153, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
  - .2 A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .3 A276, Standard Specification for Stainless Steel Bars and shapes.
  - .4 A322, Steel Bars, Alloy, Standard Grade.
  - .5 A36, Standard Specification for Structural Steel.
  - .6 A366, Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
  - .7 A385, Standard Practice for Providing High-Quality Zinc Coatings (Hot Dip).
  - .8 A572, High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality.
- .8 AWS A5.4. Stainless Steel Electrodes for Shielded Metal Arc Welding.
- .9 National Electric Manufacturers Association (NEMA):

.1 1 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

1.5 SHOP DRAWINGS

.1 Provide shop drawings in accordance with the requirements of Section 01 33 00 and Section 00 50 00. In addition, provide the following information:

.1 Descriptive literature, brochures, and/or catalogues of the equipment.

.2 Details of attachment and support system.

.3 Details for all chutes and attached hoppers, showing geometry, attachments, welding design, and fasteners. Indicate coordination points with adjacent equipment and describe any special conditions that have to be met.

.4 Design details and functional description of any instrumentation components supplied. Catalogue data on all ancillary electrical components.

.5 Gear reduction unit service factor.

.6 Manufacturer's data including materials of construction and equipment weights.

.7 Written control narrative providing a complete description of system operation.

.8 Letter, stamped by a Professional Engineer from a province in Canada, certifying the proposed products meet the requirements in this and related sections in their entirety, specifically:

.2 Design calculations identifying the maximum conveyance capacity of each conveyor set, and the factor of safety used for determining the sizing of each conveyor set.

.1 Confirmation that trough sizing will allow each conveyor to meet the specified trough fill percentage limitations under average and peak loadings.

.2 Peak loading, and maximum possible rotational speed of equipment.

.3 Confirmation of motor location on pull end for all conveyors.

.4 Refer additionally to Clause 2.4.

.9 Flow and pressure requirements for flushing nozzles.

.10 Safety provisions.

.2 Refer to Clause 3.3 for materials properties reports to be provided as a submittal.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operating and maintenance data in accordance with requirements of Section 01 78 39.

1.7 COORDINATION

.1 Refer to Section 00 50 00 for general coordination requirements.

.2 Coordinate the connections between successive screw conveyors.

1.8 **SHIPMENT, PROTECTION, AND STORAGE**

.1 Ship, unload, protect, and store equipment in accordance with Section 01 60 60 and Section 00 50 00.

Part 2 **Products**

2.1 **FUNCTION**

.1 Screw conveyors are intended for the transport of dewatered sludge cakes collected from two (2) centrifuges (one (1) new, one (1) existing) in the Genset building

.2 Two (2) screw conveyors, both at inclines of thirty (30) degrees from the horizontal plane transport dewatered sludge cakes from the two (2) centrifuges to one (1) main screw conveyor at inclines of thirty (30) degrees from the horizontal. This main screw conveyor transports dewatered sludge cakes to a disposal bin. Identification below:

.1 **Screw Conveyor No.1**: Transports sludge cakes from both conveyor No. 2 and 3 to the disposal bin

.2 **Screw Conveyor No.2**: Transports sludge cakes from existing centrifuge to Screw Conveyor No.1

.3 **Screw Conveyor No.3**: Transports sludge cakes from new centrifuge to Screw Conveyor No.1

.3 Under normal operation, Screw conveyors No.1 and No.3 are operational and Screw conveyors No.2 is on standby. All conveyors may run continuously at any time at the operator's choosing. In particular, continuous operation is expected during peak solids generation conditions coinciding with peak Plant flow.

2.2 **EQUIPMENT TAG NUMBERS**

.1 Tagging system will be identified at the Shop Drawing stage and will be ISA based.

2.3 **DESIGN STANDARD AND ACCEPTABLE MANUFACTURERS**

.1 Supply products modified as necessary by the manufacturer to provide the specified features and to meet the specified operating conditions.

.2 Provide the entire screw conveyance using products from a single supplier only. Systems bearing equipment from two (2) or more suppliers will be rejected by the Engineer without review.

.3 Acceptable manufacturers:

.1 Spirac USA Inc.

.2 Spiral Engineering Inc.

.3 JDV Equipment Corporation

.4 Atara Equipment Ltd.

.5 Jim Myers & Sons, Inc.

.6 BioSec Enviro Inc.

.7 Claro Inc.

2.4 DESIGN REQUIREMENTS

Provide conveyor equipment capable of optimum performance within the following:

Table 411200-A: Conveyor Design Requirements

Name of Unit		Conveyor No. 1	Conveyor No. 2	Conveyor No. 3
Number of Units		One (1)	One (1)	One (1)
Operating Period	h/d	6	Standby	6
	d/wk	2.5	Standby	2.5
	h/wk	15	Standby	15
System Design				
Maximum Speed	Rpm	25	25	25
Incline to horizontal	degrees	30	30	30
Number of Discharges	No.	1	1	1
Discharge Type		Vertical	Vertical	Vertical
Slide Gate		No	No	No
Location of Drives		Pull End	Pull End	Pull End
Design Operating Equipment		Class I, Zone 1	Class I, Zone 1	Class I, Zone 1
Variable Frequency Drive		No	No	No
Design Conditions				
TS in Cake	TS kg/hr	513	85.5	427.5
Performance Requirements				
Cake Discharge Flow	m3/hr	2.55	0.51	2.04

.1 Conveyor trough sizing

.1 Minimum trough sizing for each conveyor set is defined in Table 411200-A. Provide a bid on the conveyor sizes listed.

.2 Should it be determined that conveyors of larger size are required in order to meet the design requirements herein, provide modifications to meet the design requirements. Include modifications to support stands, diverter chutes, and other ancillary components to account for the revised physical sizing. Ensure the overall arrangement of conveyors does not change.

.2 Trough fill percentage

.1 Design conveyors to meet service at 50% of the conveyor's trough filling capacity. Each conveyor drive unit and spiral shall be designed for 90% of the conveyor's trough fill rate capacity. The conveyor start-up shall be based

on a fully loaded (90% full) conveyor. Design the system for continuous operation.

.3 Conveyor incline

.1 Conveyors incline acceptable is 30 degrees to the horizontal.

.4 Rotational speed

.1 Screw rotation shall not exceed 25 rpm when the conveyor is operated to provide maximum conveyance rate.

.5 Motor location

.1 Locate all drive motors at the 'pull' end. Conveyor drainage to be directed to drive end.

2.5 MATERIALS OF CONSTRUCTION

.1 Fabricate screw conveyors of the following materials:

.1 Conveyor trough, top covers, inlet hoppers, chutes, supports: 304 / 304L stainless steel

.2 Spiral flights (conveyors): Manufacturer's standard high strength low alloy (HSLA) steel or high-chrome steel, minimum hardness 300 BHN.

.3 Wear liner: Ultra-high molecular weight polyethylene.

.2 Construct screw conveyor of quality and strength so that it does not deform or fail, even if unusual objects discharge into the trough.

.3 Refer to below clauses for specific design requirements of each component.

2.6 CONVEYOR TROUGH

.1 Provide U-shaped troughs conforming to the dimensional standards of CEMA 350. Use minimum 4.5 mm thick stainless steel plate. Design conveyors such that the curved section of the trough is oriented in the downward direction when installed.

.2 Equip trough with side flanges for attaching top covers.

.3 Provide framing edges to accommodate an interior liner as required for the service.

.4 Extend the trough a minimum of 75 mm above the top of the screw.

.5 Provide inlet and discharge connection flanges of the size and at the locations indicated on the Contract drawings.

.6 Discharge flange shape and sizing:

.1 Discharge flanges to be rectangular.

.2 Length shall be no shorter than 1.5 screw pitches.

.3 Width shall be equal to the full width of the conveyor trough.

.7 Trough section length:

.1 Supply each individual conveyor trough section in lengths of 5 metres or shorter.

.2 Provide conveyor trough sections in shorter sections where the maximum trough length would limit access to the flanges for conveyor disassembly.

.8 Conveyor drainage:

.1 Provide flanged connection at the base of the trough on the inlet side for drain pipe connection. Drain piping downstream of flange to be supplied by Contractor.

.2 Locate drain as close as possible to the conveyor's drive end, without placing the drive at risk of plugging or damage.

.3 For dry screenings service, provide perforated or wedge wire stainless steel drainage plate with 6 mm perforations to prevent loss of compacted screenings through the drain. Length of drainage plate section shall be 1 spiral pitch, covering full width of the trough. The drainage plate shall be accessible for cleaning from the outside surface of the conveyor, without lifting of the screw. Equip the spiral in the drainage section with a replaceable brush designed to clear the drainage plate of accumulated screenings. Provide 100 mm drain flange.

2.7 INLET HOPPER FROM DEWATERING EQUIPMENT

.1 Provide the inlet hopper to the inclined conveyors No. 2 and No. 3 from the dewatering equipment discharge piping.

.2 Coordinate with the selected dewatering equipment supplier for specific design of the hopper.

.3 Provide hopper to the conveyor No. 1 from conveyors No.2 and No.3.

.4 For the full length of the inlet hopper along the axis of conveyance, provide the screw with a sharp, serrated edge to break compacted sludge cakes into smaller pieces for improved conveyance. The serrated edge to extend for the length of the screw which is exposed in the hopper.

.5 Expose the upper half of the screw into the structure of the hopper in order to facilitate the cutting action of the serrated edge.

2.8 CONVEYOR COVERS

.1 Provide top covers for the complete length of each conveyor. Design each conveyor cover to be maximum 1,500 mm length or shorter, with a width of the cover equivalent to the trough size at the top of the U-shape. Equip each section of cover with handles to assist with removal.

.2 Include perimeter gaskets on covers to minimize escape of odours.

2.9 INSPECTION HATCHES

.1 Provide square, hinged and gasketed conveyor inspection hatches, at intervals of approximately three (3) metres, for operator inspection. Regardless of length, provide minimum of two (2) inspection hatch per conveyor.

.2 Raised inspection hatch by a minimum of 150 mm from the surface of the cover. Hatch to be integral with the cover.

.3 Include a mesh at the top of the inspection hatch to prevent accidental physical interaction with the screw.

2.10 SPIRAL SCREW

.1 Provide shaftless (centreless) screws with outer and inner concentric spirals for all conveyors supplied for this system.

.2 Cold-form sprials from flat bars using materials specified in Clause 2.5, as applicable to each conveyor application. Select thickness of bar forming the spiral as required to withstand the stressed imposed by conveyance. Design flights with adequate stability to prevent distortion and jumping in the trough.

.3 Design spiral such that its torsional rating exceeds the torque rating of the drive motor at 150% of its nameplate horsepower.

.4 The ‘spring effect’ of the spiral shall not exceed 1.0 mm per 100 mm of length under maximum load conditions.

.5 Minimum outer spiral thickness is 25 mm for all specified spiral sizes.

.6 Incorporate a welded flange on the drive end of the spiral for connection to the gear reducer.

.7 Terminate screw at the edge of the final discharge opening closest to the drive end (or at edge of the sole discharge opening, if only one opening), in order to mitigate the possibility of solids accumulation at the discharge, leading to conveyor damage.

.8 Design screw for forward and reverse operation.

2.11 UHMWPE WEAR LINER

.1 Incorporate 16 mm (5/8”) UHMWPE liner covering a minimum of 180 degrees of the trough. Provide two colour liner to indicate to users when the liner nears the end of its useful life.

.2 Fasten liners to the conveyor trough using stainless steel fasteners. Design liners to slide into the framing edge integral with the trough.

.3 Provide liners in sections no longer than 1,200 mm, which may be removed and installed without physically removing the screw from the conveyor trough.

2.12 STRUCTURAL SUPPORTS

.1 Provide supports for all conveyors supplied. Fabricate supports from the same material as the conveyor trough.

.2 Coordinate support locations with facility structures and equipment layout. Do not place supports where they would restrict access to other process systems.

.3 Support Loads: Based on design maximum fill of troughs, weight of the conveyors, and dynamic loading when operating.

.4 Design supports to safely carry the weight of the conveyors with completely filled trough to CAN/CSA S16.1 or AISC allowable stresses.

.5 Design supports to not exceed 1/3 of AISC allowable stresses when loaded to twice the running torque of the motor.

.6 Provide minimum one (1) support at the drive end, one (1) support at the discharge end, one (1) support at wall openings. Supplier to advise if additional supports are required.

.7 Support legs to be adjustable, with a range of 100 mm from the fabricated length in order to match site conditions.

.8 For supports resting on or in contact with any metals, provide dielectric isolation to prevent corrosion.

2.13 CHUTES

.1 Minimum thickness 3 mm, flanged, flanges 1/4” thick, Type 304 stainless steel.

.2 Flexible connections to centrifuge to suit cake discharge.

.3 Flexibe connections to conveyors No.2 and No.3

.4 Rigidly supported from slabs or structural members, following manufacturer's recommendations.

2.14 DISCHARGE BOOT

.1 Provide elastomeric discharge boot on each outlet in order to accurately direct sludge cakes into the conveyor or disposal bin below. Size boot to fit the discharge opening.

.2 Discharge boot to be fabricated from Buna-N elastomer.

.3 Extend boot to 200 mm above the top of the container. Ensure the boot attachment mechanism is easily accessible for removal and servicing.

2.15 **FLUSHING CONNECTIONS**

.1 Include on each conveyor 304 stainless steel flushing water nozzles for intermittent conveyor cleaning. Locate nozzles at a maximum of spacing of 3 metres per nozzle set.

.2 Arrange nozzles such that the spray pattern provides full coverage of the conveyor trough.

.3 Provide 25 mm inlet connection with quick coupling and manual ball valve to allow control of flushing flow rate.

.1 If required based on location of the conveyor, extend piping so that the quick coupling is no higher than 1.2 m above the operating level on which the conveyor is supported.

.4 Provide flow and pressure requirements for flushing nozzles with Shop Drawings.

2.16 **SEALS**

.1 Compression packing gland between the drive shaft and sleeve.

.2 Use water tight design, incorporating labyrinth seals or a similar approach to eliminate water transmission from with the conveyor.

2.17 **GEAR REDUCING DRIVE**

.1 Design for full thrust loads from spiral flights.

.2 Bearings: Operating life of L-10 100,000 hours.

.3 AGMA, Class II reduction helical gears, service factor 1.4.

.4 Air cooled, no auxiliary cooling allowed.

.5 Close coupled with drive motor.

.6 Coordinate to correctly orient the drive at right angle to the spiral's rotational axis as required based on site conditions and positioning of interconnections.

.7 Applied Torque: Adequate to start the screw conveyor when fully loaded.

2.18 **MOTORS**

.1 Locate all conveyor motors located at the pull end.

.2 Supply motors rated for service in a Zone 2 environment for the inclined and horizontal dry screenings conveyors, which operate partially or entirely in the classified screening area.

.3 Provide total enclosed, fan cooled (TEFC) type motors for outloading conveyor, suitable for service in moist and corrosive area.

.4 Safety factor: select motors to deliver 150% of the power required under maximum rotation and maximum solids loading conditions.

2.19 ELECTRICAL CONNECTIONS

.1 Motor starters will be located in remote motor control centre. Ensure specific drive requirements are submitted with the Shop Drawings.

.2 Refer to Section 01 60 12 specifications for electrical requirements

2.20 INSTRUMENTATION

.1 Provide the following instruments and control devices on each conveyor:

.1 Motor overtorque switch (dedicated device)

.2 Non-contact motion sensing unit.

.3 Safety trip wire, mounted along the side of the unit and connected to a safety E-Stop switch.

.2 For conveyor sets located in the classified area, provide instruments suitable for long term operation in Zone 1 environment.

.3 Provide other control devices and instruments not specified for safe, reliable operation. Refer to Section 01 70 12 specifications for instrumentation requirements.

2.21 CONTROLS

.1 The Plant control system will provide control of the conveyance system equipment. An independent control system is not required as part of the supplied package.

.2 Provide a local control panel to accept/house all field instrumentation proposed, and to be wired back to the PLC and MCC. Field control panel to allow for manual forward and reverse control, emergency stop, and to place equipment into automatic mode by the site control system. Non-contact motion sensing device to be integrated into this local control panel.

.3 Provide complete screw conveyance system sequencing philosophy to the Contractor, Engineer, and District for incorporation into the Plant's programming.

2.22 ANCILLARY COMPONENTS

.1 Nuts, bolts, and other fasteners, Type 316 stainless steel.

.2 Furnish lifting lugs for equipment assemblies and components weighing over 40 kg.

.3 Equipment identification plates shall be 16-gauge stainless steel securely mounted on each piece of equipment in a readily visible location. The identification numbers shall be a minimum of 6 mm die stamped.

2.23 **PROTECTIVE COATINGS**

.1 Provide corrosion resistant coatings for equipment and piping in accordance with Section 46 90 00.

2.24 **SPARE PARTS**

.1 Submit a list of recommended spare parts, including current prices and anticipated delivery times, required to maintain the screw conveyors in reliable operation for five (5) years. Submit the list of recommended spare parts with submission of shop drawings of equipment.

.2 Provide the following spare parts:

.1 One pull cord safety switch.

.2 Two (2) standard lengths of UHMWPE liner for each conveyor diameter supplied using this type of liner.

2.25 **SPECIAL TOOLS AND ACCESSORIES**

.1 Provide any special tools required for the maintenance of the equipment supplied. Special tools are defined as tools which are not normally available in mechanic's or millwright's tool kit and which are peculiar to the equipment supplied.

.2 Furnish all gauges, indicators and lubricating devices necessary for the proper operation of the equipment, whether such accessories are specified.

Part 3 **Execution**

3.1 **FABRICATION, ASSEMBLY AND INSPECTION**

.1 Fabricate, assemble and match mark the equipment in the factory for inspection by the Engineer.

.2 Give the Engineer 3 weeks' notice in writing to enable the Engineer to inspect the pre-assembled equipment, including shop painting.

.3 The Engineer may waive the right to inspect the equipment at the factory.

.4 Provide every reasonable facility, access and cooperation to assist the Engineer in carrying out inspection of the fabrication, assembly and testing at the factory.

3.2 STAINLESS STEEL FABRICATION

.1 During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.

.2 After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.

.3 Clean, passivate and remove contamination from stainless steel in accordance with requirements of ASTM A380 and A967.

.4 Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.

.5 After treatment, visually inspect surfaces for compliance.

3.3 MATERIAL PROPERTIES VERIFICATION

.1 During manufacturing, prior to shipment, engage the services of a certified materials testing firm to verify the hardness of the following products:

.1 Spiral flights

.2 Submit name and qualifications of the independent testing firm for approval of the Engineer.

.3 Provide test results on one supplied length of spiral for each type of conveyor.

.4 Submit test results for the Engineer's record. Results will be examined for compliance with the materials specifications of Clause 2.5 only.

.5 The Engineer will reject products which do not meet the specifications. Remanufacture with materials meeting the specifications, at no cost to the District.

.6 The District and Engineer reserve the right to conduct quality assurance field testing of supplied materials, at the District's own cost.

3.4 SHIPMENT, PROTECTION, AND STORAGE

.1 Ship equipment to the Work Site in accordance with Section 01 60 60.

.2 Ship pre-assembled to the greatest degree possible. Confirm with the Manufacturer any site assembly requirements.

.3 Identify each component with durable labels or tags securely attached to each piece of equipment or container.

.4 Store and protect equipment per Manufacturer's requirements and advice in order to prevent damage, undue stress or weathering.

.5 When the Supplier and Contractor are satisfied that the equipment has been delivered in its entirety without damage, complete the **"Certificate of Equipment Delivery" (Form 100)**. Deliver the completed form to the Engineer.

.6 The removal and replacement of damaged equipment items as a result of shipping to be at no cost to the District.

3.5 MANUFACTURER'S REPRESENTATIVE

.1 Arrange for a technically qualified Manufacturer's Representative to attend the installation work, train operating and maintenance staff and undertake the testing of the system for sufficient periods to ensure the equipment is installed, operated, and maintained in accordance with the Manufacturer's recommended procedures.

.2 The minimum periods of site attendance are identified in the following table along with the Form to be completed on each of these trips. A "day" is defined as eight working hours on site.

Item	Description	No. of Days per Trip	Form
1	Witnessing of Equipment Installation	2	100, 101,102
2	Operator and Maintenance Training (combined with Items 2 and3)		T1
3	Equipment Performance Testing		103
4	Equipment Performance Commissioning		104
5	Process Performance Testing		105
6	End of Warranty Inspection	1	-

.3 The total number of trips will depend on the Contractor's schedule. The cost of additional trips, to be determined by the Engineer, will be borne by the Contractor.

3.6 INSTALLATION

.1 The Supplier's Representative shall verify satisfactory delivery of the equipment by completing Form 100, illustrated at the end of Section 41 12 00.

.2 The Supplier's Representative shall instruct the Contractor in the methods and precautions to be followed in the installation of the equipment. Certify the Contractors' understanding by completing Form 101, illustrated at the end of Section 41 12 00.

3.7 INSTALLATION WITNESSING

.1 The Contractor shall ensure the equipment is installed plumb, square and true within the tolerances specified by the Supplier and as indicated in the Contract Documents.

.2 The Contractor shall ensure that the equipment is installed as required to provide satisfactory service.

.3 The Supplier's Representative shall cooperate with the Contractor to deliver a successful installation as documented by Form 102 illustrated in Section 46 76 00.

3.8 **PERFORMANCE TESTING**

.1 The Supplier's Representative shall ensure the equipment, including all component parts, operates as intended. The testing procedure is set out in Section 3.9.

.2 The Supplier's Representative shall cooperate with the Contractor to test the equipment as documented by Form 103, illustrated in Section 01 65 00.

3.9 **TESTING**

.1 Conduct testing accordingly to prove equipment operation, performance, and function in accordance with Section 01 65 00.

.2 Fulfill the requirements for successful testing of the equipment as documented by the **"Certificate of Satisfactory Equipment Performance" (Form 103)**, illustrated in Section 01650.

3.10 **PERFORMANCE TESTING**

.1 Following successful equipment operational testing (**Form 103**), subject all conveyors to Performance Testing (PT) to demonstrate compliance with the performance requirements.

.2 The intent of the PT procedure is to demonstrate the installed equipment's ability to operate satisfactorily and meet the peak solids conveyance capacities listed in Table 411200-A, Clause 2.4 and other clauses herein.

.1 Specifically, PT shall demonstrate each conveyor supplied can reliably transport the peak solids loading, operating at the defined maximum trough fill of 100%, at a rotational speed of 25 rpm or lower.

.3 If, at the time of testing, the Engineer determines that solids captured from the wastewater treatment process are insufficient for Performance Testing, or the process has not yet been commissioned, additional solids of the same type the conveyor is designed to transport will be loaded into the conveyor to facilitate this testing.

.4 Should the conveyance equipment fail Performance Testing (in the opinion of the Engineer), provide modifications to the equipment supplied in order to meet the performance criteria at no additional cost to the District, and pay the District's and the Engineer's costs for performance of additional Performance Tests to demonstrate compliance of the modified system. Include any structural, process, mechanical, electrical, instrumentation, and controls modifications, as necessary to achieve the performance requirements specified in this Section, and pay for an additional Performance Test.

.5 Should the conveyance equipment fail Performance Testing on a second attempt, at the discretion of the Engineer and at no cost to the District, replace the conveyor(s) which fail to pass Performance Testing as specified with conveyor(s) which will meet the requirements outlined. Include modification of any ancillaries, such as diverter chutes, conveyor supports, piping, electrical, instrumentation and other items directly associated with the conveyor which requires replacement due to failure to pass Performance Testing.

.6 Following replacement of the failed conveyors, perform additional Performance Testing to demonstrate compliance of the replacement equipment. Pay the costs of the District and the Engineer to support these Performance Testing periods.

.7 On successful completion of the PT, sign the "**Certificate of Satisfactory Performance Testing" (Form 105)** with the Contractor, Engineer, and the District.

.8 "Certificate of Satisfactory Performance Testing" (Form 105) is a prerequisite to Form 104.

3.11 TRAINING

.1 Provide the services of a qualified technical representative for personnel training

.2 During equipment operational testing provide as a minimum:

.1 Operation training: 1 sessions, 2 hr each

.2 Maintenance training: 1 sessions, 2 hr each

.3 On successful completion of the training, sign the "**Certificate Of Satisfactory Training" (Form T1)** with the Contractor, Engineer, and the District.

3.12 COMMISSIONING

.1 A field service technician or start-up engineer of the Screw Conveyor Supplier shall commission the screw conveyors.

.2 Local manufacturer's representatives are not acceptable to perform these tasks unless authorized by the Screw Conveyor Supplier.

.3 The field service technician shall certify that all equipment is properly installed and that the plant operators have been trained on proper operation and maintenance procedures

.4 The minimum recommended man-days / trips for installation inspection, system commissioning, and operator training shall be as follows:

.1 Inspection of installation: typically a minimum of one (1) man-day / one (1) trip.

.2 Start-up/system commissioning: typically a minimum of one (1) man-day

.3 Operator training: typically a minimum of one (1) man day

.5 Contractor and Manufacturer's Representative to be in attendance during commissioning of the process system that includes the equipment specified in this section to ensure the equipment functions as intended in the process system as documented by **Form 104**. Cooperate with the Commissioning Team in developing the Commissioning Plan for this equipment. Provide assistance as required for system programming, start-up and troubleshooting.

.6 The Supplier's Representative shall provide training to the Owner's Designated Staff in the proper operation and maintenance of the equipment as documented by **Forms T1**

3.13 **END OF WARRANTY INSPECTION**

.1 After a period designated by the Owner (approximately 24 months after commissioning), a qualified representative will provide a follow-up inspection of the screw conveyors installation.

END OF SECTION

CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100

We certify that the equipment listed below has been delivered into the care of the Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date

(Authorized Signing Representative of the Contractor)

Print Name	Signature	Date

(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name	Signature	Date

(Authorized Signing Representative of the Engineer)

CERTIFICATE OF EQUIPMENT INSTALLATION INSTRUCTIONS

FORM 101

I have familiarized the Contractor of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Supplier or Manufacturer)

I certify that I have received satisfactory installation instructions from the equipment Manufacturer or Supplier.

_____ _____

_____ _____

Print Name Signature Date
(Authorized Signing Representative of the Contractor)

CERTIFICATE OF SATISFACTORY EQUIPMENT INSTALLATION
FORM 102

I have completed my check and inspections of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

_____ _____
Print Name Signature Date
(Authorized Signing Representative of the Supplier or Manufacturer)

_____ _____

_____ _____
Print Name Signature Date
(Authorized Signing Representative of the Contractor)

CERTIFICATE OF SATISFACTORY SYSTEM OPERATIONAL TESTING
FORM 103

We certify that the Major Equipment listed below has been operated for at least three (3) successful days (with the last three (3) days to be consecutive) and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The piece of equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date

(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name	Signature	Date

(Authorized Signing Representative of the Contractor)

Print Name	Signature	Date

(Authorized Signing Representative of the Engineer)

I Acknowledge Receipt of the O&M Manuals, training and spare parts (**OM1, OM2, OM3, T1, and SP1 Forms** complete)

Print Name	Signature	Date

(Authorized Signing Representative of the District)

CERTIFICATE OF SATISFACTORY COMMISSIONING
FORM 104

We certify that the Sooke WWTP Screw Conveyors has been operated, tested and commissioned as per the Contract Documents for at least three (3) successful days (with the last three (3) days to be consecutive) and that the equipment meets its operational and performance criteria, including fully automatic controls. The treatment equipment is therefore classed as “conforming”.

PROJECT: _____

FACILITY: _____

_____

_____

_____

_____ _____

Print Name Signature Date

(Authorized Signing Representative of Contractor)

_____ _____

Print Name Signature Date

(Authorized Signing Representative of the Engineer)

_____ _____

Print Name Signature Date

(Authorized Signing Representative of The Town)

CERTIFICATE OF SATISFACTORY PERFORMANCE AND/OR GUARANTEED PERFORMANCE TESTING
FORM 105

We certify that the equipment listed below has been tested and meets the Performance and/or Guaranteed Performance Testing requirements as set out in the Work.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date

(Authorized Signing Representative of the Supplier or Manufacturer)

Print Name	Signature	Date

(Authorized Signing Representative of the Contractor)

Print Name	Signature	Date

(Authorized Signing Representative of the Engineer)

Print Name	Signature	Date

(Authorized Signing Representative of The Town)

CERTIFICATE OF SATISFACTORY TRAINING
FORM T1

We certify that the Sooke WWTP designated Staff has received satisfactory training in the proper operation and maintenance of the equipment listed below.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

Print Name	Signature	Date
(Authorized Signing Representative of the Supplier or Manufacturer)		
Print Name	Signature	Date
(Authorized Signing Representative of the Contractor)		
Print Name	Signature	Date
(Authorized Signing Representative of the Engineer)		
Print Name	Signature	Date
(Authorized Signing Representative of The Town)		

Part 1 General

1.1 WORK INCLUDED

.1 The supply and application of all factory applied prime coats or factory applied finish coats.

1.2 SUBMISSIONS

.1 With the equipment Shop Drawings, the Contractor shall submit details of the coating systems to be applied.

1.3 QUALITY ASSURANCE

.1 This specification is intended to be a minimum reference standard. The manufacturer may submit for review alternative coating systems for specific items of equipment which provide equal or better corrosion protection and maintenance service than those specified herein.

Part 2 Products

2.1 SURFACE PREPARATION

.1 Immersion Service: After degreasing, dry blast all ferrous components to a white metal finish in accordance with SSPC-SP5 to a degree of cleanliness in accordance with NACE #1 and obtain a 50-micron blast profile.

.2 Non-immersion Service: After degreasing, dry blast all ferrous components to a near white finish in accordance with SSPC-SP10 to a degree of cleanness in accordance with NACE #3 and obtain a 50-micron blast profile.

2.2 PRIME COATING

.1 Prime coat all ferrous surfaces before the blasted surfaces deteriorate.

.2 Coat ferrous surfaces with inorganic zinc primer, containing a minimum of 50 percent solids by volume, applied to a minimum dry film thickness of 75 microns.

2.3 FINISH COATS

.1 Apply finish coats in conformance with Section 46 90 00 – Field Applied Corrosion Protection and Maintenance Coatings for service, coating types and application rates.

2.4 ASSEMBLY

.1 Items which are to be bolted together before shipment shall have their surfaces cleaned and coated before the parts are assembled.

.2 Continuous weld all welded connections, sealing the mating surface completely. On completion of the welding and fettling, treat all weld seams with phosphoric acid solution. Rinsed and thoroughly dry before the prime is applied.

.3 Where dissimilar metals are mated such as aluminum and steel, insulate the mating surfaces from one another to provide protection against corrosion. Insulate bolts, nuts, washers and rivets in a similar manner.

.4 Use Type 304 stainless steel or better for all nuts, bolts, washers and similar fittings for immersion service. Nuts, bolts, washers, and similar fittings for non-immersion service shall be Type 304 stainless or zinc or cadmium plated. The inner face of non-threaded bolt holes are to be cleaned and coated as required for other surfaces.

Part 3 Execution

3.1 INSPECTION

.1 The manufacturer shall notify the Engineer two (2) weeks before commencing the protective coating in order to facilitate the inspection by the Engineer of the surface preparation and protective coating application.

3.2 PROTECTION

.1 Protect all coated equipment adequately against damage, dust, moisture and scratching during shipment, off-loading and storage on-site. If, in the opinion of the Engineer, the coating is damaged during shipment to the extent that touch up would not be satisfactory, the equipment shall be returned and re-coated at no added cost to the Owner.

.2 Damage to coatings occurring at any time shall be made good prior to the application of any further coatings.

3.3 APPLICATION CONDITIONS

.1 Apply all factory applied coatings under controlled conditions. The atmosphere shall be dust free and kept at a temperature of between 10°C and 20°C. The relative humidity should not exceed 80 percent.

END OF SECTION