DISTRICT OF SOOKE

WWTP EXPANSION PROJECT 2022

CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE - 2 2008

STIPULATED PRICE CONTRACT

July 2022

DISTRICT OF SOOKE

WWTP EXPANSION PROJECT 2022

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The complete Contract Documents consist of the following parts:

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    - Invitation to Tender
    - Instructions to Tenderers
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2. District of Sooke: WWTP Expansion Project 2022 Drawing Package

3. 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 EXPANSION PROJECT 2022

The District of Sooke is inviting qualified General Contractors for a Stipulated Price Contract (CCDC2, 2008) for the construction of a WWTP upgrade at the existing 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 SBR 3 equipment, sludge thickener, polymer system, and sludge feed pump via Novation Agreement.
2. Assume responsibility of Owner Supplied sludge thickener discharge pump via free issue.
3. Construction of a new SBR3 tank and installation of SBR3 equipment
4. Construction of EQ tank and installation of EQ tank pump.
5. Construction of thickener platform and chemical room with thickener package equipment installation including thickener, thickener sludge feed pump and polymer system.
6. Construction of WAS tank
7. The installation of a new domestic water lines with emergency eye wash/shower and electric hot water tank in the polymer room.
8. The installation, programming and commissioning of instrumentation and controls for the above-mentioned equipment.
9. Construction and installation of all associated equipment listed on the drawings and specifications.
10. Testing, commissioning of all equipment and process areas 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:	**Wednesday August 24th, 2022**
Delivered to:	2205 Otter Point Road Sooke, BC V9Z 1J2 **ATTN: Jeff Carter, Director of Operation**
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 EXPANSION PROJECT 2022

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 via email to:

ATTN: Shaun Swarbrick
Stantec Consulting Ltd.
400-655 Tyee Road
Victoria, BC V9A 6X5
Email:
shaun.swarbrick@stantec.com
Fax: 250.507.5876

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 SBR 3 equipment, sludge thickener, polymer system, and sludge feed pump via Novation Agreement.

1.2.2 Assume responsibility of Owner Supplied sludge thickener discharge pump via fee issue.

1.2.3 Construction of a new SBR3 tank and installation of SBR3 equipment

1.2.4 Construction of EQ tank and installation of EQ tank pump.

1.2.5 Construction of thickener platform and chemical room with thickener package equipment installation including thickener, thickener sludge feed pump and polymer system.

1.2.6 Construction of WAS tank

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

1.2.8 The installation, programming and commissioning of instrumentation and controls for the above-mentioned equipment.

1.2.9 Construction and installation of all associated equipment listed on the drawings and specifications.

1.2.10 Testing, commissioning of all equipment and process areas and switch over to District ownership

1.3 Direct all tender inquiries regarding the *Contract*, to:
Shaun Swarbrick, P.Eng, Project Manager, Telephone: 250.507.5876
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: **August 24th, 2022**

Delivered to: District of Sooke, 2205 Otter Point Road
Sooke, BC V9Z 1J2
ATTN: Jeff Carter, Director of Operations

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 Non-Mandatory Site Meeting

A Non-Mandatory Site Meeting will be held at the site at 7113 West Coast Road (Sooke WWTP) at 10am on Friday 5th August, 2023.

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 mid September 2022.

The Contract is required to be substantially complete by October 30th , 2023.

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 2022

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 October 30th 2023 subject to receipt of a *Notice to Proceed* being issued on or before September 30th 2022 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 09 - PAINT	1	LS	
DIVISION 22 - PLUMBING	1	LS	
DIVISION 25 – INTEGRATED AUTOMATION			
Item 7.1 – Instruments and Control Devices and Wiring	1	LS	
Item 7.2 – Package Equipment Wiring Interconnections	1	LS	
Item 7.3 – SCADA PLC Programming/Integration	1	LS	
DIVISION 26 – ELECTRICAL			
Item 8.1 – Electrical Equipment and Wiring	1	LS	
Item 8.2 – Motor Control Centre and Installation	1	LS	
Item 8.3 – Commissioning Support	1	LS	
Item 8.4 – Other Electrical	1	LS	
DIVISION 31 - EARTHWORKS			
Item 9.1 - Excavation	1	LS	
Item 9.2 – Import Fill	1	LS	
DIVISION 32 – SURFACE IMPROVEMENTS			
Item 10.1 – Access Road Construction	1	LS	
Item 10.2 – Walkway Construction	1	LS	
DIVISION 33 – SITE UTILITIES			
Item 11.1 – Water Piping	1	LS	
Item 11.2 – Sanitary Sewer Piping	1	LS	

Description	Quantity	Unit	Total Price ($)
DIVISION 40 – PROCESS INTEGRATION			
Item 12.1 – Process Piping Valves and Gates	1	LS	
Item 12.2 – Other Process Appurtenances	1	LS	
DIVISION 43 – PROCESS EQUIPMENT			
Item 13.1 –EQ Tank Pumps	1	LS	
Item 13.2 – Rotary Drum Thickener Feed Pump	1	LS	
Item 13.3 – Tertiary Disk Filter	1	LS	
DIVISION 44 – POLLUTION CONTROL EQUIPMENT			
Item 14.1 – Sequencing Batch Reactor	1	LS	
Item 14.2 – Rotary Drum Thickener	1	LS	
Item 14.3 – Polymer Feed System	1	LS	
		Sub-Total:	**$**
		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_____, 2022, 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
DRAFT NOVATION AGREEMENT

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

AND: _____
CONTRACTOR)

AND: **XYLEM CANADA LP**
(SUPPLY CONTRACTOR)

WHEREAS:

A. District entered into a Contract with the Supply Contractor dated AUGUST 2022, for the Supply and Delivery of Wastewater Equipment: SBR 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 [WWTP Upgrade 2022] (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 $490,546.99 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_____, 2022:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2022:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

XYLEM CANADA LP

by its authorized signatory on_____day of____, 2022:
SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

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

AND: _____
CONTRACTOR)

AND: **JWC ENVIRONMENTAL Inc.**
(SUPPLY CONTRACTOR)

WHEREAS:

F. District entered into a Contract with the Supply Contractor dated June 1st 2022, for the Supply and Delivery of Wastewater Equipment: Rotary Drum Thickener, Rotary Drum Thickener Feed Pump and Polymer System (Supply Contract), which is annexed hereto as Appendix "7";

G. 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;

H. District entered into a contract with Contractor dated [____], for [WWTP Upgrade 2022] (Construction Contract);

I. 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;

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

8 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.

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

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

11 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.

12 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.

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

14 It is agreed that as of the date hereof $251,842.50 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_____, 2022:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2022:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

JWC ENVIRONMENTAL Inc.

by its authorized signatory on_____day of____, 2022:
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 1st day of June, 2022.

BETWEEN: JWC Environmental Canada ULC (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.

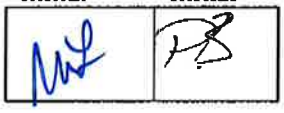
8. No action or failure to act by the District or an authorized representative of the District shall constitute a waiver of any right or duty afforded any of them under the Contract or constitute an approval or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

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 fall 2022).



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

DISTRICT OF SOOKE

by its authorized signatory on 1st day of June, 2022:

SIGNED on behalf of the District by:

Signature: _____

Name: Paul Bohemier

Title: Manager of Wastewater

JWC Environmental Canada ULC

by its authorized signatory on 7th day of June, 2022:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: Marvin Lee

Title: VP Finance

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;

JWC Environmental Inc
2850 S. Red Hill Ave., Suite 125
Santa Ana, CA 92705
P: 949-833-3888
F: 714-242-0240
E: jwce@jwce.com

May 3, 2022

District of Sooke
2205 Otter Point Road
Sooke, British Columbia
V9Z 1J2 Canada

Attn: Paul Bohemier, Manager of Wastewater
Re: District of Sooke WWTP Upgrades 2022

Please find enclosed our bid for the above referenced project. If you have any questions, please contact Bonnie Wong at 604-291-7150.

Sincerely,

JWC ENVIRONMENTAL

Eric K. Elam
Inside Technical Sales

JWC Environmental Canada
2889 Norland Avenue
Burnaby, BC
Canada V5B 3A9
P: 604-291-7150
F: 604-291-7190
E: sales@ipec.ca

April 29, 2022

Project: District of Sooke WWTP Expansion
Equipment Supply and Delivery
Clarifications to General Conditions

The following clarifications are offered by JWC Environmental Canada ("Supply Contractor").

1. Add new ARTICLE "Limitation of Liability. Notwithstanding anything to the contrary in the Contract, including all documents making part thereof, in no event shall Supply Contractor be liable for loss of profit, indirect, punitive, special, incidental or consequential damages of any kind. The liability of the Supply Contractor under this Contract shall not exceed (i) the proceeds actually paid out on claims against the Supply Contractor's insurance policy, or (ii) for liability to which such insurance does not apply, 100% of the Contract Price, provided, however, the Supply Contractor shall remain liable without limit for its gross negligence or wilful misconduct."

TENDER FORM

Contract: SUPPLY AND DELIVERY OF WASTEWATER 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:

Addendums 1 and 2

(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 WASTEWATER 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 Rotary Drum Thickener summarized in Section 44 43 26 and drawings as part of this Tender package.	1	LS	$ 78,390	$ 78,390
2	Supply and delivery of Rotary Drum Thickener Feed Pump summarized in Section 43 25 13 and drawings as part of this Tender package.	1	LS	$ 24,490	$ 24,490
3	Supply and delivery of Polymer System package summarized in Section 44 44 36 and drawings as part of this Tender package.	1	LS	$ 23,490	$ 23,490
4	Supply and delivery of Control Panel package summarized in Section 44 43 26 and drawings as part of this Tender package.	1	LS	$ 113,480	$ 113,480
				GST (5%) of total	$ 11,992.50
				Total	$ 251,842.50

(1) The tender assessment is based on the total price for all items related to each equipment package. No claims for lost profit will be allowed from any tenderer if the optional items do not become part of the contract.

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 2023.

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	5 weeks	4 weeks
2	Equipment Delivered to Site Weeks following completion of Shop Drawing Review	20 weeks	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	24 hours, 365 days a year
2	Technician Availability	Same day / overnight/ other (describe) * 3 - 14 days after scheduling
3	Part availability (including rectifier and electrolytic cells)	Same day / overnight/ other (describe) * 1 - 14 days depending on stock
4	Local Service Provider	Company: JWC / IPEC Canada Years' Experience with Manufacturers Equipment: 40 Local Address: 2889 Norland, Ave., Burnaby, BC Canada V5B3A9

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 GRANGE COUNTY, CA USA this 3RD day of MAY, 2022.

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

SIGNED

by JWC ENVIRONMENTAL INC
(Print Company Name)

By its authorized signatory (ies):

(Signature)

GREGORY B. QUEEN, PRESIDENT
(Print Name and Title)

JWC ENVIRONMENTAL INC. CORPORATE COMPANY 2011 DELAWARE

END OF SECTION

BID BOND

Standard Construction Document
CCDC 220 - 2002

Bond No.: MNR218802-22-02

Bond Amount: 10% of tender price

JWC ENVIRONMENTAL INC. as Principal, hereinafter called the Principal, and CHUBB INSURANCE COMPANY OF CANADA a corporation created and existing under the laws of Canada and duly authorized to transact the business of Suretyship in Canada as Surety, hereinafter called the Surety, are held and firmly bound unto

DISTRICT OF SOOKE

as Obligee, hereinafter called the Obligee, in the amount of Ten percent of tender price (10% of tender price) lawful money of Canada, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal has submitted a written bid to the Obligee, dated 6th day of May, in the year 2022 for

WWTP Expansion Equipment Supply and Delivery (IFT 2022-004) - SUPPLY AND DELIVERY OF WASTEWATER EQUIPMENT INCLUDING: ROTARY DRUM THICKENER, ROTARY DRUM THICKENER FEED PUMP, POLYMER SYSTEM, AND CONTROL PANEL

The condition of this obligation is such that if the Principal shall have the bid accepted within the time period prescribed in the Obligee's bid documents, or, if no time period is specified in the Obligee's bid documents, within Sixty (60) days from the closing date as specified in the Obligee's bid documents, and the Principal enters into a formal contract and gives the specified security, then this obligation shall be void; otherwise, provided the Obligee takes all reasonable steps to mitigate the amount of such excess costs, the Principal and the Surety will pay to the Obligee the difference in money between the amount of the bid of the Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former.

The Principal and Surety shall not be liable for a greater sum than the Bond Amount.

It is a condition of this bond that any suit or action must be commenced within seven (7) months of the date of this Bond.

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

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond dated 27th day of April, in the year 2022

SIGNED and SEALED in the presence of

JWC ENVIRONMENTAL INC.

Signature

GREGORY B. QUEEN

Name of person signing

JWC ENVIRONMENTAL INC. CORPORATE COMPANY 2011 DELAWARE

CHUBB INSURANCE COMPANY OF CANADA

Signature

Roxanne Villa, Attorney In Fact

Name of person signing

BOND No.: MNR218802-22-02

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

CHUBB INSURANCE COMPANY OF CANADA

(Insert Bonding Company's Name)

do hereby undertake and agree to become bound to District of Sooke for a PERFORMANCE BOND for

One Hundred Fifty Five Thousand DOLLARS ($ 155,000.00)

(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

JWC Environmental Inc.

(Insert Tenderer's Name)

Dated at Sooke, British Columbia, this 29th day of April, 2022.

Yours very truly,

Signature and Corporate Seal of Surety Company Licensed to Conduct Business in the Province of British Columbia

Roxanne Villa, Attorney In Fact

PERFORMANCE BOND

Standard Construction Document
CCDC 221 - 2002

Bond No. MNR501128 **Bond Amount:** $ 125,921.25

JWC ENVIRONMENTAL CANADA ULC as Principal, hereinafter called the Principal, and CHUBB INSURANCE COMPANY OF CANADA a corporation created and existing under the laws of Canada and duly authorized to transact the business of Suretyship in all provinces and territories of Canada, as Surety, hereinafter called the Surety, are held and firmly bound unto

DISTRICT OF SOOKE as Obligee, hereinafter called the Obligee, in the amount of One Hundred Twenty Five Thousand Nine Hundred Twenty One and 25/100 **Dollars** ($ 125,921.25) lawful money of Canada, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal has entered into a written contract with the Obligee, dated 20th day of May, in the year 2022 for IFT 2022-004 Rotary Drum Thickener, Rotary Drum Thickener Feed Pump and Polymer System District Of Sooke WWTP Expansion Upgrades. hereinafter referred to as the Contract.

The condition of this obligation is such that if the Principal shall promptly and faithfully perform the Contract then this obligation shall be null and void; otherwise it shall remain in full force and effect.

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

1) remedy the default, or;

2) complete the Contract in accordance with its terms and conditions or;

3) obtain a bid or bids for submission to the Obligee for completing the Contract in accordance with its terms and conditions and upon determination by the Obligee and the Surety of the lowest responsible bidder, arrange for a contract between such bidder and the Obligee and make available as work progresses (even though there should be a default, or a succession of defaults, under the contract or contracts of completion, arranged under this paragraph) sufficient funds to pay to complete the Principal's obligations in accordance with the terms and conditions of the Contract and to pay those expenses incurred by the Obligee as a result of the Principal's default relating directly to the performance of the work under the Contract, less the balance of the Contract price; but not exceeding the Bond Amount. The balance of the Contract price is the total amount payable by the Obligee to the Principal under the Contract, less the amount properly paid by the Obligee to the Principal, or;

4) pay the Obligee the lesser of (1) the Bond Amount or (2) the Obligee's proposed cost of completion, less the balance of Contract price.

It is a condition of this bond that any suit or action must be commenced before the expiration of two (2) years from the earlier of (1) the date of Substantial Performance of the Contract as defined in the lien legislation where the work under the Contract is taking place, or, if no such definition exists, the date when the work is ready for use or is being used for the purpose intended, or (2) the date on which the Principal is declared in default by the Obligee.

The Surety shall not be liable for a greater sum than the Bond Amount.

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

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond dated 25th day of May, in the year 2022.

SIGNED and SEALED in the presence of

JWC ENVIRONMENTAL CANADA ULC

Signature

Marvin Lee

Name of person signing

JWC ENVIRONMENTAL INC CORPORATE COMPANY 2011 DELAWARE

CHUBB INSURANCE COMPANY OF CANADA

Signature

Roxanne Villa, Attorney In Fact

Name of person signing

(CCDC 221 – 2002 has been approved by the Surety Association of Canada)

BFL CANADA

181 University Ave, Suite 1700 Toronto ON M5H 3M7
T. 416-599-5530 | 1-800-668-5901 | F. 416-599-5458

CERTIFICATE OF INSURANCE
No 2021-00105

THIS IS TO CERTIFY TO:

To Whom It May Concern

that the following described policy(ies) or cover note(s) in force at this date have been affected to cover as shown below:

NAMED INSURED: **JWC Environmental Canada ULC**

ADDRESS: **2889 Norland Avenue, Burnaby, BC V5B 3A9**

Description of operations and/or activities and/or locations to which this certificate applies:

Evidence of Insurance Only

TYPE	INSURER / POLICY No	TERM		LIMITS
Commercial General Liability	XL Insurance Company SE Policy No: CA00000154LI21A	Jul 01, 2021 to Jul 01, 2022		
per occurrence inclusive Bodily Injury, Death and Property Damage			$	5,000,000
General Aggregate			$	5,000,000
Products Completed Operations			$	5,000,000
Personal and Advertising Injury			$	5,000,000
Limited Pollution (Sudden & Accidental)			$	2,000,000
Non-Owned Automobile - SPF #6			$	5,000,000
S.E.F. No. 94 - Legal Liability for Damage to Hired Automobiles - Subject to $1,000 All Perils Deductible			$	30,000
Including; Broad Form Property Damage, Contractual Liability, Cross Liability, Contingent Employer's Liability				

Additional Information

This certificate is issued as a matter of information only and is subject to all the limitations, exclusions and conditions of the above-listed policies as they now exist or may hereafter be endorsed.

Should one of the above-noted policies be cancelled before the expiry date shown, notice of cancellation will be delivered in accordance with the policy provisions.

Limits shown above may be reduced by Claims or Expenses paid.

BFL CANADA Risk and Insurance Services Inc.

Authorized Representative
Morene Williams

Signed in Toronto this June 21, 2021

IFT 2448 Rotary Drum Sludge Thickener for Sooke WWTP

Quoted by JWC Environmental IPEC for District of Sooke, BC under Proposal No. 20211139 R2

JWC Environmental Canada ULC 2889 Norland Avenue Burnaby, BC V5B 3A9 CANADA Tel: 604-291-7150 Fax: 604-291-7190 Toll Free: 800-663-8409 Email sales@jwce.com Web Site: jwce@jwce.com

.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 of Sooke

(DISTRICT)

AND:

(CONTRACTOR)

AND:

JWC Environmental Canada ULC

(SUPPLY CONTRACTOR)

WHEREAS:

A. District entered into a Contract with the Supply Contractor dated [6/1/22], for the Supply and Delivery of Wastewater 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 [6/1/22], for [$251,842.50] (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 [$ 251,842.50] 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 1st day of June, 2019: 22.

SIGNED on behalf of the District by:

Signature: _____

Name: Paul Bokemier

Title: manager of wastewater.

[CONTRACTOR'S NAME]

by its authorized signatory on _____ day of _____, 2019:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

JWC Environmental Canada ULC

by its authorized signatory on 7th day of June 2022 ~~2019~~:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: Marvin Lee

Title: V.P. of Finance

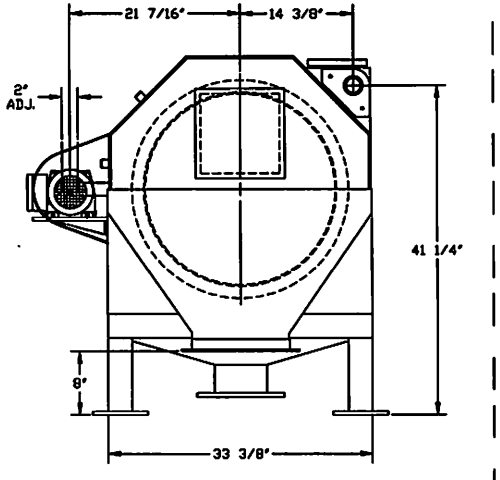
Signature: _____

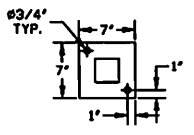
Name: _____

Title: _____

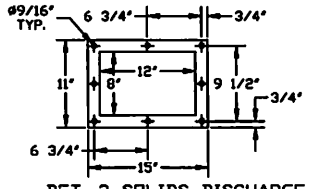
END OF SECTION

Tenderer's Initial	Owner's Initial





DET. 1 FRAME FOOT



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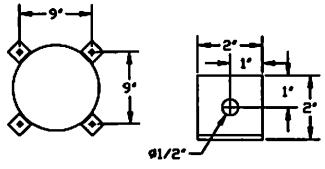
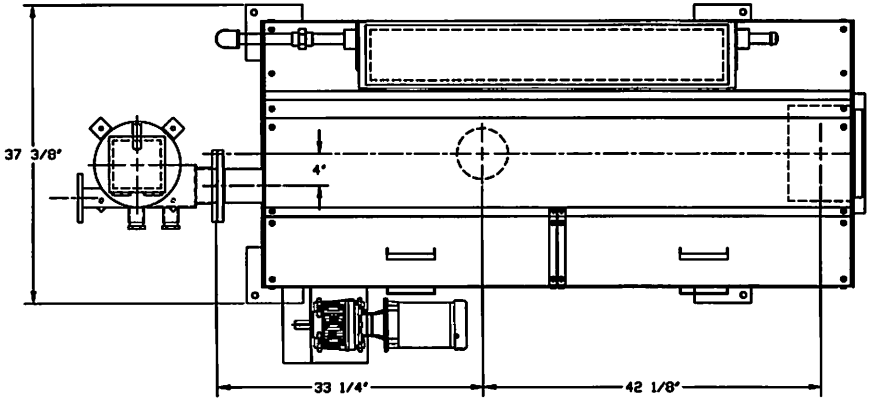
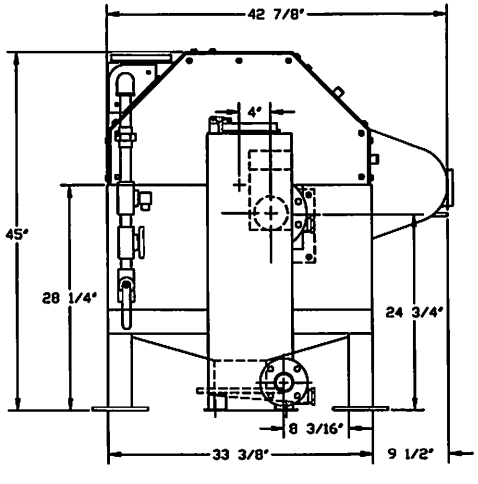
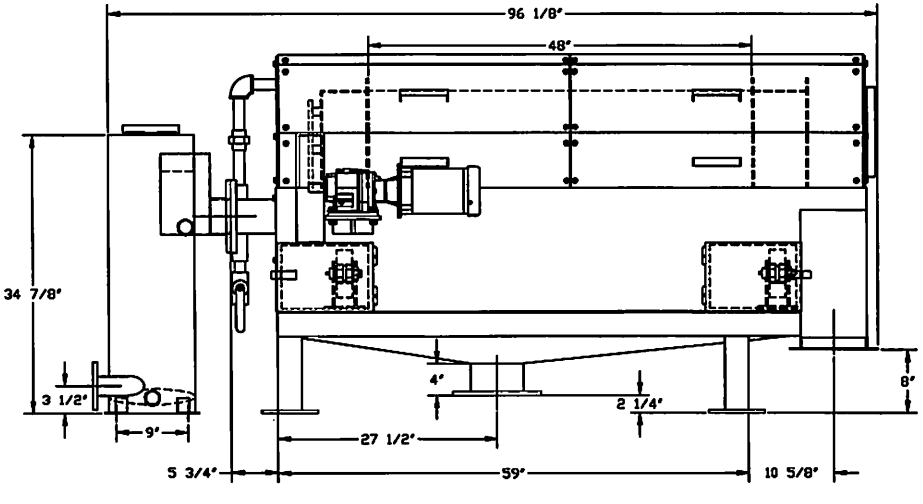


DET. 3 TANK BASE & FOOT







COMPONENTS

ITEM	P/N	DESCRIPTION
1	2244 2/2	SCREEN DRUM DIM: ø24" X 48" CONST: CAGE / MESH PANEL MATERIAL: 304 SS MESH: 425/500
2	14252	HOUSING DIM: AS NOTED CONST: 3" X 3" X 1/8" TUBE 2" X 2" X 1/8" TUBE 11 GAUGE MATERIAL: 304 SS FITTINGS: 1) EFFLUENT: 6" SCH10 C/W 304 SS FLANGE 2) SOLIDS: 8" X 12" FLANGED
3 3A 3B 3C 3D 3E 3F	 34248 34275 34252 34253 31242 31244	COVER SPRAYBAR SIDE (1): 12 GA. TOP (1): 12 GA. ACCESS 1: 12 GA. ACCESS 1: 12 GA. INF END: 12 GA. DISC END: 12 GA. MATERIAL: 304 SS
4	44282	HEAD BOX CONST: 11 GA MATERIAL: 304 SS FITTINGS: 1) INFLUENT: 4" SCH10 C/W 304 SS FLANGE 2) DRAIN: 2" FNPT C/W PLUG
5		DRIVE SYSTEM DRIVE UNIT: EURODRIVE MODEL: R37AM56 MOTOR: MARATHON G843 1/3 HP 575/3/60 1750 RPM, INTEGRAL TRUNNIONS: ø6" X 2"UHMW POLYURETHANE CHAIN: #60-SS SPROCKETS: L) 60A90-SS S) 60JA12-SS ACCESSORIES: 1) CHAIN GUARD 304 SS
6	5125631 S	SPRAY BAR HEADER: 1" SCH40 PIPE x 57 1/2" CONNECTIONS: 1 1/4" MNPT EACH END MATERIAL: 304 S.S. NOZZLES: 14 FAN JET/ 1 GPM @40 PSI ACCESSORIES: 1" BALL VALVE 1" PRV 1" SOLENOID VALVE 0-100 PRESSURE GAGE
7		TANK CONST: SCH 10 MATERIAL: 304 SS FITTINGS: OUTLET- ø4" ID PIPE SS FLANGE INLET - 2" IPS 150# SS FLANGE DRAIN- 2 @ 2" FNPT C/W PLUG ACCESS- 6" X 6"

NOTES

1) UNIT TO BE MOUNTED IN A LEVEL POSITION
2) NOT SHOWN: TRUNNION ACCESS COVERS

SYM.	DESCRIPTION	DATE	BY

REVISIONS

CUSTOMER: ***
***

PROJECT: ***
***

TITLE: IFT 2448

JWCC

JWCC ENVIRONMENTAL CANADA ULC
2889 NORLAND AVE
BURNABY BC
CANADA V5B 3A9
1 800 663 8409

QUOTE NO: ***
PROJECT: ***
SCALE: ***
DRAWN: A.R.C.
CHKD: A.M.L.
DWG. NO: T2448301
REV. 0
DATE: APRIL 24, 2018
DATE: APRIL 24, 2018

1.0 GENERAL

1.1 System Overview

The thickener system shall be a combination of a rotary drum thickener and an floc swirl tank unit designed to develop stable floc from raw sludge.

The rotary thickener system shall consist of a structural housing that supports all components and encloses the lower section including: a thickener drum with the filtration elements, floc swirl tank, influent headbox with flow distribution plates, external shower wash header, chain and sprocket drive with gearmotor, cover and access door.

A floc development system shall consist of a vertical swirl tank. The tank shall be mounted on the inlet section of the rotary thickener.

1.2 Basic Operation

Raw sludge is treated with flocculant chemicals prior to entering bottom of flocculation swirl tank. Sludge reacts under a gentle rotation of water. Treated sludge spills from the top of the tank into the headbox of the thickener. The sludge is then distributed evenly onto the interior sidewall of the drum. The liquid separates from the flocculated solids by passing through the mesh. Under rotation, solids are directed to the discharge end of the drum. Liquid extractions will progress slower due to increasing sludge consistency. The shower header continually directs water onto the mesh orifices to clean off entrained solids. The filtrate collects under the drum and discharges from a drain at the bottom of the housing.

1.3 Operating Parameters

The IFT unit is designed to achieve the following performance parameters;

Throughput:	126 lb/hr, total dry biosolids, municipal WAS.
Influent Consistency:	0.80%
Thickened Sludge Consistency:	4.0% - 6%
Capture:	96% - 98%

Actual performance may vary depending type of solids, optimization targets and chemical selection and cost. Prior to selection and/or commissioning bench scale testing will confirm the yields that can be achieved.

2.0 CONSTRUCTION AND MATERIALS

2.1 Screen Drum

The thickener drum structure shall consist of cylindrical end rings connected by flat bar members. The flat bars are positioned to accept mesh panels which are attached from the outside of the drum. The panels fit tightly between cage structure and framer bars around the drum. The mesh panels shall be staged in multiple opening (porosity) patterns, with the openings increasing in porosity in progressive dewatering stages as the sludge travels axially along the drum.

Mesh is provided based on openings size, percent of open area and wire size to optimize throughput rate, filtration quality and final sludge consistency.

The thickener drum shall be equipped with stainless steel diverter flights attached to the flat bars to continually move solids to discharge end of the screen drums.

2.1.1 End Rings

The solid end section of the drum on which the wheels ride shall be constructed of 1/4 inch thick type 304 stainless steel plate and shall have radial support flange constructed from 3/8 inch by 2 inch flat bar.

The influent end plate shall be constructed in 3/16 inch type 304 stainless steel. A drum cylinder stabilizer assembly at the discharge end of the cylinder shall assist in maintaining the cylinder in the proper axial position.

2.1.2 Mesh Panels

The mesh panels are formed by bonding polyester mesh onto PVC coated stainless steel expanded metal. The panels (approximately 2 foot by 3 foot) have a rubber border 3/4 inch by 5/16 inch that is also bonded onto the expanded metal.

2.2 Housing

The housing shall be unitary fabrication consisting of tube structural members and mechanical mounting plates enclosed within side, end and bottom panels constructed in 11 gauge sheet. All components are welded together to form the housing. The housing encloses the drum up to the axial centerline.

The housing supports the drum, mechanical components, headworks and upper covers.

Part of the housings structural tubes extends to from a base for the flocculation tank. The housing has four legs, one at each corner.

Base plates are provided on each leg to secure the unit to the floor.

The bottom panel should slope to a central discharge point to a 6 inch 150# SCH 10 complete with stainless steel ANSI flange.

2.2.1 Covers

The cover sections are bolted to the housing and are constructed from 12 gauge type 304 stainless steel. Each enclosure panel can be easily detached to give access to the outside of the drum. The end cover shall have a hinged inspection door with latches.

2.3 Influent, Headbox and Distribution

The headbox shall mount on the inlet end of the housing and extends to the interior of the drum. Internal baffles and splash plates shall distribute water evenly onto the sidewall of the screen drum.

The headbox shall have an inlet pipe complete with 150# stainless steel ANSI flange. A 2 inch clean-out port, complete with end cap shall be installed in the headbox. The complete headbox assembly shall be constructed in 10 gauge type 304 stainless steel plate.

2.4 Rotation System

2.4.1 Wheels

The screen shall rotate on the four wheels, complete with internal bearings. Each wheel shall be made of UHMW polyurethane, 6 inch diameter by 2 inches thick. The internal bearings shall be double row ball bearings with double up seals with two sets mounted in each wheel.

2.4.2 Drive Assembly

A 1/3 horse power TEFC EX Class 1 Div. 1 motor c/w VFD, 575 volts, 3 phase, 60 hertz and a helical gear reducer shall drive the screen drum. There shall be a 1.15 service factor on the motor and a minimum of 1.7 service factor on the gear reducer. The drive chain shall be #60 stainless steel roller chain.

The large driven full ring shall be 1-3/4 inches wide by 1/2 inch thick and constructed in type 304 stainless steel. A smaller drive sprocket shall be constructed in type 304 stainless steel.

The section of the drive chain outside the housing shall have a guard cover constructed in 14 gauge type 304 stainless steel.

2.5 Spray Bars

2.5.1 External Spray Bar

An intermittently operated external spray bar, constructed of 1 inch SCH 40 type 304 stainless steel pipe, shall be mounted on the cover. The spray bar shall have 14 stainless steel fan spray nozzles space at 3 inch intervals, each rated at a hydraulic capacity of 1 USGPM at 40 psi. A hinged cover over the full length of the spray bar shall prevent splashing and allow access for maintenance.

2.5.2 Spray Collection

An internal spray collector will be provided to catch the excess spray wash water and prevent it falling on the thickened sludge. It shall be fabricated from 12 gauge, type 304 stainless steel.

2.6 Flocculation Swirl Tank

The swirl tank will be 10-3/4 inches in diameter by 34-7/8 inches in height manufactured in 10 gauge type 304 stainless steel. The tank will have flanged 4 inch inlet and 6 inch outlet fittings and a 2 inch FNPT drain complete with drain plug. The tank shall have a 6 inch by 6 inch hinged access door on the top.

2.7 Piping Connection

Connection for the inlet and outlet shall be of type 304 stainless steel stub ends with ANSI stainless steel flanges.

2.8 Surface Finish

2.8.1 Surface Treatment of Stainless Steel Components

Welds shall be acid passivated with pickling paste by brushing on all welds and overlapping into heat affected zones. Paste shall be left on for 1 to 2 hours before water flush and neutralization with soda ash solution.

All surface blemishes and weld tacks shall be blended smooth and the complete surface shall be glass bead polished to a uniform finish. After polishing the surface shall be rinsed then passivated using citric acid solution. Solution shall be sprayed onto screens and left for 30 minutes before water flushing the complete surface.

After drying, all surfaces shall be coated with a thin film for superior corrosion resistance.

2.8.2 OEM Components

The motor, gear reducer and all unit-mounted electrical devices will have the manufacturer's standard finish.

3.0 FACTORY ASSEMBLY, TESTING AND INSPECTION

The unit will be factory operated and inspected prior to shipment. The Engineer and/or Owner may, at their option and own expense, witness the factory test.

4.0 INSTALLATION

The equipment shall be installed per JWCE - IPEC's recommendation. All electrical connections shall be made as specified herein, identified on the drawing.

5.0 MANUALS

Two (2) copies of the operation and maintenance manual.

MONSTER DRUM THICKENER

IFT Series

The IFT Series of drum thickeners offers best-in-class performance for sludge wastewater treatment. This sludge dewatering equipment is designed for achieving 5 to 12% solids depending on the type of sludge. The unit can handle solids loading up to 1900 lbs/hr (862 kg/hr) of WAS and 2850 lbs/hr (1293 kg/hr) for primary sludge, depending on the amount of solids content. The Monster Drum Thickener is designed to minimize operating costs while provide superior overall results.

JWC's Monster Drum Thickener utilizes woven wire mesh for the construction of the sludge thickener screening panels. The woven wire mesh panel construction allows for capture rates in excess of 98% which is some of the highest available for sludge dewatering equipment. This performance translates to much lower polymer usage compared to other sludge dewatering equipment that utilizes perforated plates or wedgewire drums. The woven wire mesh screening media is constructed as individual panels which can be easily removed from the frame of the sludge thickener's rotary drum. This feature allows for a simple exchange of screening panels without having to replace a full drum if the panels are damaged or conditions change.

For sludge wastewater treatment systems, the faster the sludge floc structure is established and brought into the sludge thickener, the more efficient the system can run. JWC has designed the Monster Drum Thickener to require an incredibly short dwell time in the flocculation tank to achieve the required floc structure. This means the unit will use less polymer and require a smaller tank compared to other rotary drum sludge dewatering equipment.

The Monster Drum Thickener system is fully enclosed to collect filtrate water and easily connect to a plant's odor control systems. This leads to a much cleaner and less odorous work environment when compared to other sludge thickening technologies like belt presses.

Features

Fast flocculation design

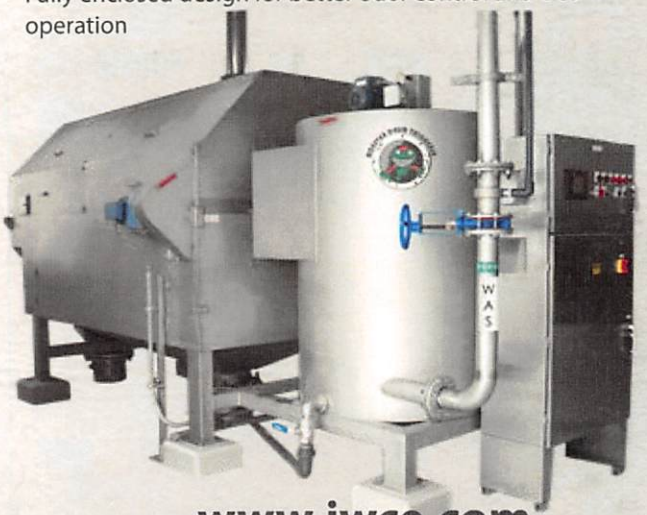
- Low polymer usage
- Small flocculation tank

Design and construction flexibility

- Removable sectional panels for effortless repair of damage or to address changes in sludge condition
- Screening media, inlet and outlet points, leg and drive placements can all be easily customized to fit a specific application

All stainless steel construction

- Includes all wetted surfaces as well as drive chains, sprockets and support frames
- Fully enclosed design for better odor control and cleaner operation



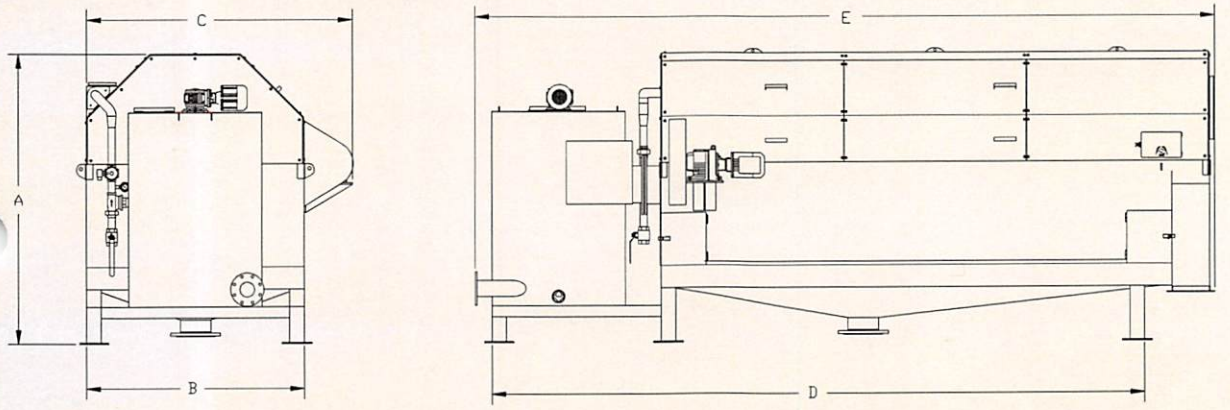
www.jwce.com

Standard Construction

- 304 stainless steel construction
- Easily replaceable woven mesh panels
- Unitary body
- Draining (filtrate) pan
- Solids chute
- TEFC motor and gear drive
- Stainless steel drive roller chain
- UHMW shaft-mounted trunnions
- External spray bar
- Polymer mixing tank with agitator
- Frame support for screen and tank

Options

- 316 stainless steel construction
- Wedgewire or perforated plate panels
- Full support base
- Control panel
- VFD
- Internal spray bar



IFT Model	Standard Dimensions - inches (mm)					Approximate Net Weight - lbs (kg)
	A	B	C	D	E	
IFT 3648	65 (1651)	46-3/4 (1187)	58-1/2 (1486)	92-1/4 (2343)	114 (2896)	2000 (907)
IFT 3672	65 (1651)	46-3/4 (1187)	58-1/2 (1486)	116-1/4 (2953)	138 (3505)	2400 (1089)
IFT 3696	65 (1651)	46-3/4 (1187)	58-1/2 (1486)	140-1/4 (3562)	162 (4115)	2900 (1315)
IFT 4872	77-3/4 (1975)	58-3/4 (1492)	71-3/4 (1822)	128 (3251)	147 (3734)	3000 (1361)
IFT 4896	77-3/4 (1975)	58-3/4 (1492)	71-3/4 (1822)	152 (3861)	171 (4343)	3500 (1588)
IFT 48120	77-3/4 (1975)	58-3/4 (1492)	71-3/4 (1822)	176 (4470)	195 (4953)	3900 (1769)
IFT 6096	94-3/4 (2407)	71 (1803)	84 (2134)	166-3/4 (4235)	186 (4724)	4800 (2177)
IFT 60120	94-3/4 (2407)	71 (1803)	84 (2134)	190.75 (4845)	210 (5334)	5400 (2449)
IFT 60144	94-3/4 (2407)	71 (1803)	84 (2134)	214-3/4 (5455)	234 (5944)	5800 (2631)

This chart is only to be used as a guide. For specific sizing inquiries please contact JWC Environmental. Not all models shown.

MODEL CODE

IFT XX XX

Drum Diameter Inches | Drum Length Inches

JWC Environmental®
A Sulzer Brand

Headquarters
2850 S. Red Hill Ave., Suite 125
Santa Ana, CA 92705 USA
toll free: **800.331.2277**
phone: **949.833.3888**
fax: **949.833.8858**
email: **jwce@jwce.com**

MUFFIN MONSTER | MONSTER INDUSTRIAL | IPEC

www.jwce.com

(Monster-IFT-NA-JWCE-0421)

1.0 GENERAL

Length	96-1/8 inches
Width	42-7/8 inches
Height	45 inches
Capacity	maximum - 50 USGPM @ 0.50% solids of industrial WAS sludge
Weight	1,500 pounds – shipping (skid) 1,600 pounds – operating 1,800 pounds – flooded

2.0 COMPONENTS AND CONSTRUCTION

2.1 Screen Drum

- material: type 304 stainless steel;
- screen cage: 3/8" x 2" and 3/8" x 1-1/2" flatbar;
- rollends: 3/16" plate with 1/4" flanges;
- panels: stainless steel mesh on PVC coated stainless steel 1-1/2 – 13 F expanded metal;
- panel configuration: 24" of 425 micron and 24" of 500 micron.

2.2 Housing

- material: type 304 stainless steel;
- splash guards: 11 gauge;
- drainage pan: 11 gauge;
- discharge chute: 11 gauge;
- legs 3" x 3" x 1/8" tubing;
- frame 2" x 2" x 1/8" tubing;
- arch framing: 2" x 2" x 1/8" tubing;
- mechanical mounts: 1/2" plate;
- drain fitting: 2" SCH 10 c/w 150" stainless steel ANSI flange;
- solids: 8" x 12" flanged.

2.3 Covers

- material: type 304 stainless steel;
- top and top sides: 12 gauge;
- ends: 12 gauge;
- fittings inspection: 12 gauge, hinged with latch.

2.4 Headbox & Internals

- material: type 304 stainless steel;
- influent pipe: 4" SCH 10 c/w 150# stainless steel flange;
- distribution tank: 10 gauge;
- drain: 2" opening;
- spray collection: 11 gauge.

2.5 External Spray Bar

- material: type 304 stainless steel;
- pipe: 1" SCH 40 and MNPT both ends, fittings c/w one (1) end cap;
- nozzles: 14 fan jet spray pattern;
- water usage: 1.0 USGPM @ 40 psi each nozzle;
- connections: connect to 1" SCH 40 manifold;
- ball valve 1" *Meridian*;
- actuated ball valve 1" *DynaQuip*;
- pressure regulator: 1" *Combraco*;
- 1-100 pressure gauge *ENFM*;

2.6 Flocculation Swirl Tank

- material: type 304 stainless steel;
- tank: SCH 10 pipe;
- influent pipe: 2" ANSI flange;
- outlet pipe: 4" SCH pipe c/w 150# stainless steel ANSI flange;
- drain fitting: 2" FNPT c/w stainless steel ball valve;
- access: 6" x 6".

3.0 MECHANICAL

3.1 Screen

3.1.1 Wheels

- 6 OD x 2" wide;
- UHMW polyurethane;
- 75 durometer.

3.1.2 Wheel Bearings

- double row ball bearings;
- double lip seals.

3.1.3 Wheel Axle

- 1" diameter.

3.1.4 Gearbox

- helical geardrive;
- ratio – 55.76 : 1;

3.1.5 Motor

- 1/3 hp;
- 1750 rpm;
- 575/3/60, TEFC EX Class 1 Div 1;
- 1.15 SF.

3.1.6 Driven Sprocket

- material: type 304 stainless steel;
- 90 tooth;
- 3/4" pitch.

3.1.7 Drive Sprocket

- material: type 304 stainless steel;
- 15 tooth;
- 1" pitch.

3.1.8 Chain

- #60 single pitch stainless steel roller chain.

LIFE EXPECTANCY TABLE

IFT 2448

COMPONENT	LIFE EXPECTANCY
Base Frame, Head Box Assembly	20 - 25 years
Drum (fabricated)	20 - 25 years
Screen Panels	10 - 15 years
Drive (main drum)	5 - 10 years
Drive (floc tank agitator)	5 - 10 years
Driven Sprocket (large)	5 - 10 years
Drive Sprocket (small)	3 - 5 years
Drive Chain	3 - 5 years
Drum Wheels (Trunnions)	3 - 5 years
Stabilizer Assembly	3 - 5 years
Solenoid Valve	3 - 5 years

JWC ENVIRONMENTAL CANADA ULC
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Email: info@jwce.com Web Site: www.jwce.com

UGSI Chemical Feed
SOLUTIONS

POLYMER ACTIVATION SYSTEMS

POLYBLEND®
DYNABLEND™
POLYMER FEED SYSTEMS

Proper Polymer Activation is the Key

UGSI Chemical Feed, Inc. pioneered the development of cost-effective polymer activation technologies for water and wastewater applications by following the science of polymer activation.

Backed by decades of scientific research and field experience gained from more than 65 years and 10,000 installations, Polyblend® mechanical and Dynablend™ hydraulic polymer activation systems deliver significant operational savings by reducing the consumption of polymers used for the treatment of water and wastewater.

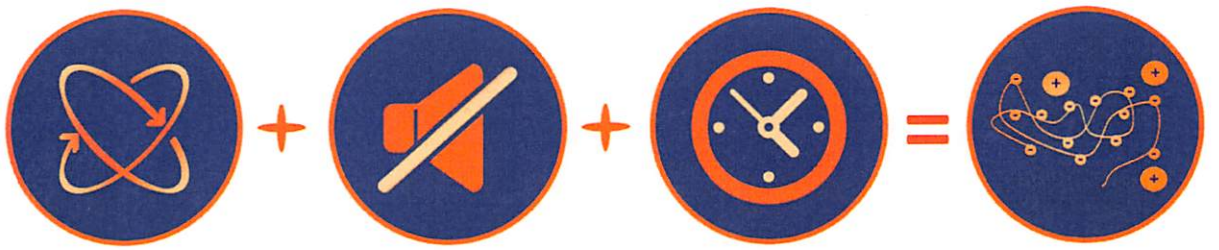
While polymers vastly improve the operation of water and wastewater plants by accelerating the settling of particles and improving sludge dewatering, polymer costs are one of the largest operating expenses at a plant. Even a small reduction in polymer consumption can result in meaningful savings. Proper polymer activation is the key to maximizing polymer effectiveness.

To get optimal "uncoiling" of polymer chains without damaging or shortening the polymer chain, different levels of energy must be applied to the polymers at different times. High shear mixing is required to prevent agglomerations, but over-mixing can damage the polymer. The key is to shift mixing energy over time to get the optimal results. Following the science of polymer activation, UGSI hydraulic and mechanical mixing technologies employ a two-zone mixing regimen of applying high energy at the moment of initial wetting (MOIW) followed by a transition to a low-energy quiescent zone, the Polyblend® and Dynablend™ polymer mixing systems can consistently achieve higher activation levels and viscosities.

We Wrote The Book

Polymer activation expert Dr. Yong Kim leads UGSI's program of rigorous testing of system activation performance. Chemists will continue to refine existing polymers and develop new ones just as they have for more than 35 years. Our ongoing equipment testing with different polymer types helps you choose the best polymer activation system for your application.

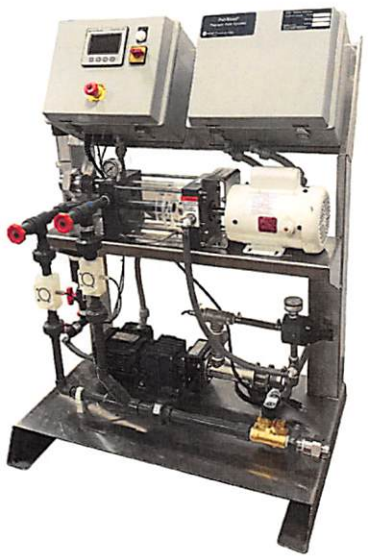
All UGSI polymer activation systems are designed using the science of efficient polymer activation



HIGH ENERGY AT MOIW + **TRANSITION TO LOW-ENERGY "QUIESCENT ZONE"** + **ADEQUATE RESIDENCE TIME** = **FULLY ACTIVATED POLYMER SOLUTION AT DESIRED CONCENTRATION**

Emulsion Polymer Activation

UGSI Chemical Feed's industry-leading emulsion polymer activation technologies use superior two-stage mixing, frequently provide polymer savings of 20%-30% compared to single-stage mixing. Optimizing mixing energy ensures consistent performance to handle new polymer developments, ultra-high molecular weights, different charge densities and new chemistries. The compact size and open-frame design enables easy installation, access, and maintenance in confined spaces. Control options range from simple manual to full PLC-based automatic control with complete SCADA interface.



Polyblend® Mechanical Mixing

- Highly efficient mixing process results in polymer savings
- Excels at high molecular weight polymers
- Ability to quantify the energy input and relate it to G value - important for high molecular weight polymers or polymers with a tight tolerance for activation
- Low maintenance cost
- Wide variety of size options
- Large installation base

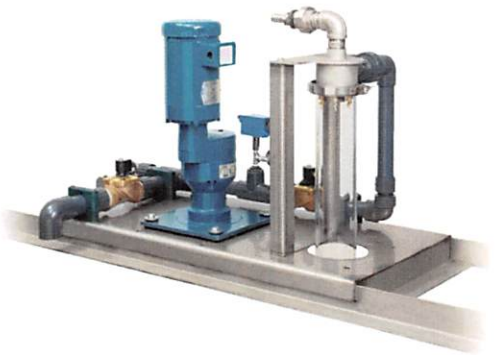
Polyblend® Mechanical Activation (Emulsion Polymer)		
Series	Water Flow Rate GPH (LPH)	Polymer Output Range GPH (LPH)
PB Series	1.6-1200 (6-4540)	0.0125-8 (0.05-30.2)
M-Low Series	3-120 (11.4-454.2)	0.0125-2.5 (0.05-9.5)
MM Series	240-3200 (912-12,113)	0.0125-660 (0.05-2508)
M Series	240-12,000 (912-45,600)	0.0125-660 (0.05-2508)

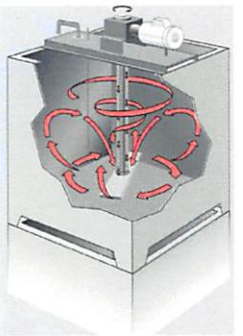
Dynablend™ Hydraulic Mixing

- Performs well with wide range of molecular weight polymers
- No moving parts in the mixing chamber
- Low operating cost
- Low maintenance cost
- Multiple mixing chamber sizes
- Highly reliable

Dynablend™ Hydraulic Activation (Emulsion Polymer)		
Series	Water Flow Rate GPH (LPH)	Polymer Output Range GPH (LPH)
MiniBlend	12-1200 (45-4543)	0.0125-5 (0.05-18.9)
L4	12-1200 (45-4543)	0.0125-20 (0.05-75.7)
L6	180-3000 (681-11,356)	0.0125-20 (0.05-75.7)
L8	360-6000 (1363-22,712)	1.5-300 (5.7-1135)
L12	900-21,000 (3407-79,494)	1.5-300 (5.7-1135)

Dry Polymer Activation





The activated polymer storage tank is specifically designed to provide fully uniform mixing intensity. The rotating impeller - known as a "hollow wing" - has a length that is more than half the width of the tank. This unique design continuously moves the solution both vertically and horizontally, creating a pump-like action that reduces agglomerations and broken polymer chains. The square tank design eliminates the potential for a damaging vortex. With minimal waste, polymer costs are reduced and polymer activation performance improved. The hollow wing impeller design is available for use with various tank sizes up to 2,000 gallons. The hollow wing design is standard on all Polyblend® dry polymer systems and optional on Dynajet™ dry polymer systems.

Polyblend® Mechanical Mixing

To create the ideal environment for the first stage of dry polymer dissolution, crucial initial wetting occurs in UGSI's DD4 disperser, where polymer and water are subjected to high energy created by mechanical mixing. The dry polymer is precisely metered into the high-energy mix chamber and properly activated with water. After brief exposure, the solution exits the high-energy disperser. The point of initial polymer / water contact is visible to the operator through a clear, acrylic interface.

Dynajet™ Hydraulic Mixing

The Dynajet™ technology uses a blower-induced pneumatic conveyance system to convey up to 12 lbs of polymer per minute from the volumetric feeder to the wetting head, with higher capacity custom systems available. The polymer is naturally dispersed in the conveyance air before introduction to the dilution water for optimum polymer-particle wetting. Polymer and water come together in a high flow shower of water produced by a minimum of six specially designed waterjets to ensure complete polymer-particle wetting. The solution that's created enters the mix tank where the polymer solution is ready for the mixing and aging process.

Polyblend® Mechanical Activation (Dry Polymer)			
Series	Water Supply GPM (LPM)	lbs. (kg) Polymer/Hr. @ 0.75% Concentration	# of Tanks/ Tank Capacity USG (L)
DP 110	10 (37.8)	4 (1.8)*	2/ 75 (283)
DP 500	20 (75.7)	16 (7.3)	2/ 160 (606)
DP 800	30 (113.6)	32 (14.5)	2/ 360 (1363)
DP 2000	30 (113.6)	62 (113.6)	2/ 750 (2839)
DP HC	115 (435)	469 (212)	2/ 7500 (23,385)

*Numbers provided are @ 0.3% concentration. UGSI does not recommend exceeding this concentration for a DP 110 system.

Dynajet™ Hydraulic Activation (Dry Polymer)			
Series	Water Supply GPM (LPM)	lbs. (kg) Polymer/Hr. @ 0.75% Concentration	# of Tanks/ Tank Capacity USG (L)
DJM-390	50 (185)	27 (12)	2/ 390 (475)
DJM-750	50 (185)	40.5 (18.3)	2/ 750 (2839)
DJM-1000	50 (185)	63 (28.5)	2/ 1000 (1363)
DJM-1500	50 (185)	87 (39.5)	2/ 1500 (5675)
DJM-2000	50 (185)	114 (51.7)	2/ 2000 (7570)
DJM-2500	50 (185)	138 (62.5)	2/ 2500 (9460)

Larger capacity systems available. Please consult your sales representative.

Mechanical or Hydraulic Mixing Technology?

UGSI Chemical Feed offers a comprehensive line of polymer activation methods with both the mechanical activation design of the Polyblend® system and the hydraulic activation design of the Dynablend™ system for all emulsion and dry polymer formulations.

So how do you know which technology is best for you?

Our team of trained experts can help determine the best technology for your application. Because we are not limited to one technology, you can feel confident knowing we're committed to finding the system that meets your process objectives.

UGSI experts help guide the equipment selection process based on the specifics of your particular application.

POLYMER ACTIVATION SOLUTION

OPERATOR EXPERIENCE
Available manpower; skill levels

PLANT SERVICES
Water and air pressure

OPERATING CYCLE
Batch or continuous

SPECIALTY APPLICATION
Explosion proof; hazardous environments

POLYMER TYPE
High, medium, low molecular weight
Branched; Anionic; Catonic; Other

BUDGET CONSTRAINTS
Operations costs vs capital

SPACE CONSTRAINTS
Dry polymer conveyance; tank configuration, headroom, etc.

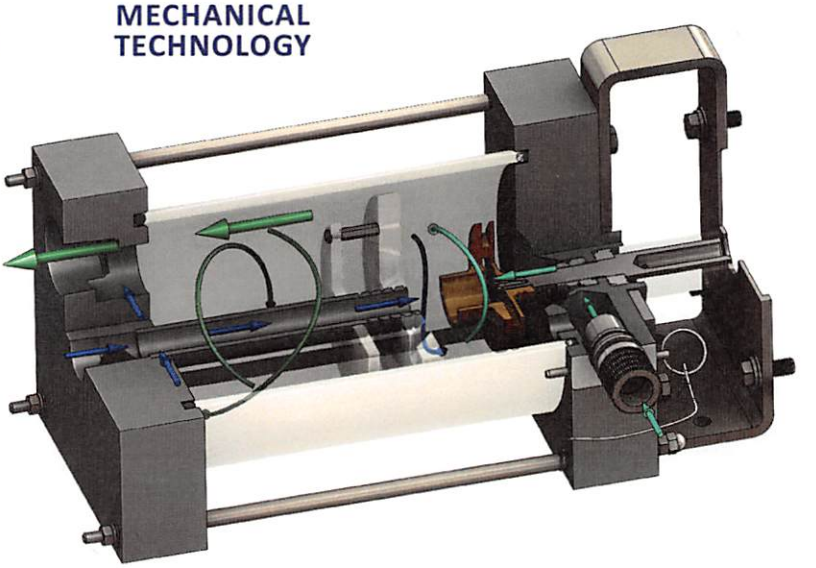
COMFORT LEVEL
Polymer activation technology history

FEED WATER MAKE-UP
Chlorine level, temperature and hardness

POLYMER CONSUMPTION

HYDRAULIC TECHNOLOGY

MECHANICAL TECHNOLOGY



UGSI Demo Program : Experience the Savings

Experience the Effectiveness

of science-based polymer mixing systems for yourself. We're so sure you'll be satisfied with a demonstration on your existing or new application, that we'll bring the on-site trial to you for a side-by-side comparison.

Polymer Feed and Control Applications

Drinking water

Groundwater remediation

Industrial process water

Wastewater

Water reuse and recycle

Available for Polyblend®, Dynablend™ and Dynajet™ polymer activation systems.

Ten emulsion systems operating in the field at any given time.

Two trailer mounted dry polymer systems available.

Highly successful program for customers and consulting engineers.

Direct evidence of demonstrated polymer savings.

Case studies available.

"The PolyBlend® DP800 Demo Trailer was very simple to use. I just set the settings and walked away; it was extremely user-friendly. The way it blends and the resulting polymer solution – and the reduction in polymer usage – made this an excellent unit."

Brad Anderson, O&M Tech V
Fairfield-Suisun Sewer District, CA

UGSI Chemical Feed
SOLUTIONS

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www.ugsichemicalfeed.com

Literature No. CF.480.000.000.SB.0419

PolyBlend® Polymer Feed System
M-Lo Series

The PolyBlend® M-Lo Series polymer feed system offers all of the benefits of the best available polymer preparation technology at a new competitive price. The ready-to-install system provides consistent and accurate dosage and improves polymer efficiency.

The PolyBlend® M-Lo System is engineered for easy installation and maintenance. The compact size of the feeder allows trouble-free installation in confined spaces and the open-frame design facilitates easy component access.

The REM-1E controller is included to provide speed control for the neat polymer pump. The easy to read LCD display indicates strokes per minute (SPM) or strokes per hour (SPH). The microprocessor based controller is housed in a NEMA 4X enclosure.

The PolyBlend® M-Lo Series polymer feed system is available in several models. The versatility of the PolyBlend® M-Lo System provides a choice of wide range of dosage rates. Multiple configurations offer the flexibility for most polymer feed applications.

Key Benefits

- Improved polymer efficiency
- Easy installation & maintenance
- Rugged & reliable design
- Direct drive mix chamber
- Pump interchangeability
- Simple electronic controls
- Competitive price

Specifications

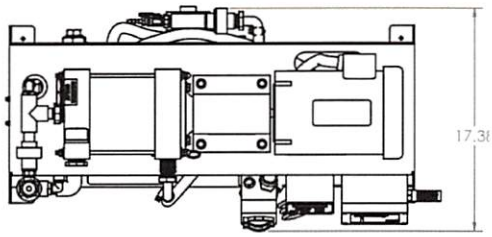
Power	115 VAC / 60 Hz / 1 Phase / 15A
Dimensions (W x H x D)	805 x 673 x 442 mm 31.7" x 26.5" x 17.4"
Polymer pump	Electronic Metering
Material	304 SS Frame / PVC
Controls	Microprocessor-based REM-1E
Connections	Water In: 12 mm (F) NPT (1/2") Discharge: 19 mm (F)NPT (3/4") Polymer: 12 mm (F)NPT (1/2")

UGSI Chemical Feed SOLUTIONS

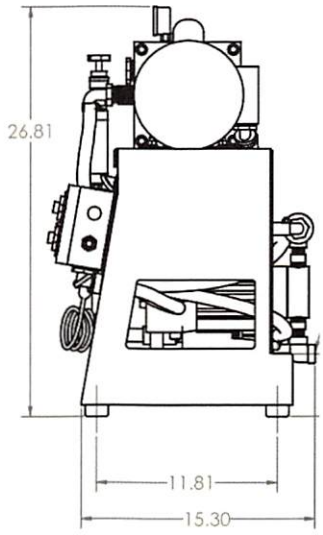
Model Selection

Model	Pump Output		Flowmeter Range		Polymer Connection (F)NPT		Water Connection		Discharge	
	LPH	GPH	LPH	GPH	mm	in	mm	in	mm	in
M20-0.5	1.8	0.5	11.4 - 83.3	3 - 22	12	1/2"	12	1/2"	19	3/4"
M20-1	3.8	1.0	11.4 - 83.3	3 - 22	12	1/2"	12	1/2"	19	3/4"
M60-0.5	1.8	0.5	22.8 - 227.1	6 - 60	12	1/2"	12	1/2"	19	3/4"
M60-1	3.8	1.0	22.8 - 227.1	6 - 60	12	1/2"	12	1/2"	19	3/4"
M120-0.5	1.8	0.5	45.4 - 454.2	12 - 120	12	1/2"	12	1/2"	19	3/4"
M120-1	3.8	1.0	45.4 - 454.2	12 - 120	12	1/2"	12	1/2"	19	3/4"
M120-2.5	9.5	2.5	45.4 - 454.2	12 - 120	12	1/2"	12	1/2"	19	3/4"

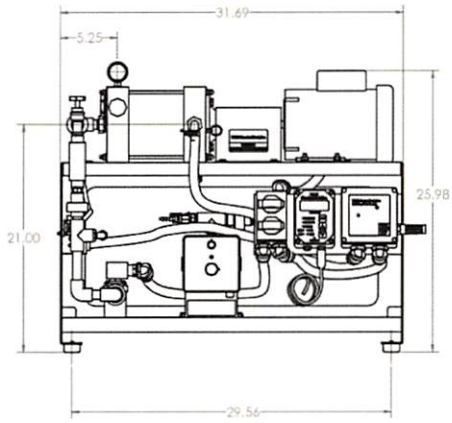
General Layout



Top View



Left Side View



Front View

Key	Description
1	Base Assembly
2	Solenoid Valve
3	Priming Port, Pump
4	Differential Pressure Switch
5	Flowmeter
6	Flow Control Valve
7	Digital Display Pump Controller, REM-1E
8	Motor
9	Solenoid Valve
10	Water Inlet
11	Polymer Inlet
12	Mix Chamber Assembly
13	Solution Discharge
14	Pressure Gauge
15	On/Off Main Power Switch
16	Mixer Motor Switch
17	Fuse (Qty 2)
18	Power Cord
19	DP Switch Relay Box

Rear View

UGSI Chemical Feed, Inc.
1901 West Garden Road
Vineland, NJ 08360
Toll Free: 855-669-3845
Local: 856-896-2160
Fax: 856-457-5920
Email: info@ugsichemicalfeed.com

Website:
www.ugsichemicalfeed.com

Data Sheet

ROYTRONIC EXCEL™ Series AD Electronic Metering Pumps

Model AD ☐☐☐ ☐☐☐☐☐

Model Code Configuration

Drive

Control Code

2 - **Dual Manual Control**
Stroke frequency and length manually adjustable, LCD display, low level indication (remote input). Display configurable to indicate theoretical pump flow.

8 - **Pulse/Analog Input w/ Dual Manual Control**
Pulse or 4-20 mA signal input controls frequency, LCD display, manual stroke length control, frequency manually adjustable when in local control, pulse multiply/divide functions, 24 V output for remote device. Includes dual low level float switch input. Display configurable to indicate theoretical pump flow.

9 - **Pulse/Analog Input w/Dual Manual Control & Enhanced Controls**
Advanced Features - Pulse or 4/20 mA signal input controls frequency, graphical display, manual stroke length control, Frequency manually adjustable when in local control, Pulse multiply/divide functions, 24 V output for remote device, dual low level float switch input, Remote on/off signal input. Outputs include: 4-20 mA, pulse, & Alarm. Remote internal/external mode input. Display configurable to indicate theoretical pump flow.

Output Code with FastPrime™ Liquid End

	Max Capacity	Max Pressure
1 -	0.21 GPH (0.8 l/h)	250 psi (17.2 Bar)
4 -	0.5 GPH (1.9 l/h)	250 psi (17.2 Bar)
5 -	1.0 GPH (3.8 l/h)	110 psi (7.6 Bar)
6 -	2.0 GPH (7.6 l/h)	50 psi (3.4 Bar)

Voltage Code

1 – 110-120V US Plug
2 – 220-240V US Plug
3 – 220-240V DIN Plug
5 – 220-240V UK Plug
6 – 220-240V Aust/NZ Plug
7 – 220-240V Swiss Plug
8 – 110-120V No Plug

Liquid End

Liquid End Code

See Accompanying Pages for Options

Liquiflam™ Size Code

1 – 0.2 in²
2 – 0.4 in²
3 – 0.8 in²
4 – 1.6 in²

Material Code

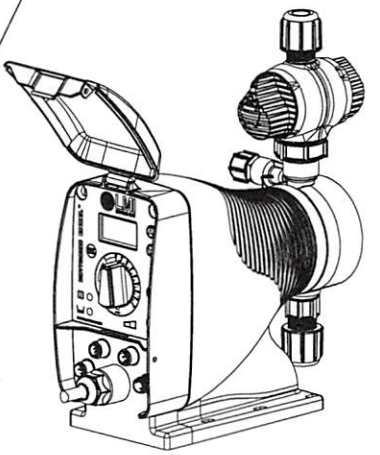
See Accompanying Pages for Options

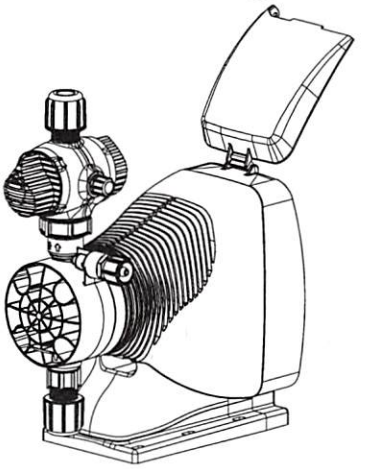
Head/Valve Code

S – FastPrime™ Head + 4FV
N – FastPrime™ Head
H – AutoPrime™ Head + 4FV
A – AutoPrime™ Head
V – High Viscosity Head
P – High Viscosity with Ported Head

Connection Code

I – Inch Tube connections with tubing
M – Metric Tube connection without tubing
U – Inch Tube connection with Black UV resistant suction/discharge tubing
P – 1/2" NPT - 1/2" BSP Pipe (SS 1/4" NPT)





Specifications

Series	Strokes Per Minute (Adjustable) Min	Max	Stroke Length (Adjustable) Recommended Minimum	Average Input Power @ Max Speed and Pressure	Max. Shipping Weight
~~AD 2X*~~					10 lbs (4.75 kg)
AD 8X*	1	120	20%	25 watts	
~~AD 9X*~~					

* where X = output code

LMI
201 Ivyland Road
Ivyland, PA 18974 USA
TEL: (215) 293-0401
FAX: (215) 293-0445
http://www.lmipumps.com

Replaces same of Rev.D 6/2012
2039.E 11/2014

Standard FastPrime™ Liquid End Configuration Data & Materials of Construction

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD91 ■ AD81 ■ AD21 ■	910SI†	1	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	915SI†	1	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	918SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	919SI†	1	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	917NP	1	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	812SI†	1	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	813SI†	1	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	818SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	718SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD94 ■ AD84 ■ AD24 ■	920SI†	2	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	925SI†	2	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	928SI†	2	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	929SI†	2	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	927NP	2	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	822SI†	2	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	823SI†	2	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	828SI†	2	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	728SI†	2	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	624 PB	2	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	626VI	2	Acrylic/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD95 ■ AD85 ■ AD25 ■	930SI†	3	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	935SI†	3	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	938SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	939SI†	3	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	937NP	3	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	832SI†	3	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	833SI†	3	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	838SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	738SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	634 PB	3	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	636VI	3	Acrylic/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD96 ■ AD86 ■ AD26 ■	940SI†	4	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	945SI†	4	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	948SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	949SI†	4	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	947NP	4	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	842SI†	4	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	843SI†	4	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	848SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	748SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	644 PB	4	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	646VI	4	Acrylic/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.

Output Information with FastPrime™ Liquid End

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
ADX1	0.002	0.21	0.01	0.8	0.132	13.2	0.011	0.11	250 psi (17.2 Bar)
ADX4	0.005	0.5	0.02	1.9	0.315	31.5	0.026	0.26	250 psi (17.2 Bar)
ADX5	0.01	1.0	0.04	3.8	0.630	63.0	0.053	0.53	110 psi (7.6 Bar)
ADX6	0.02	2.0	0.08	7.6	1.260	126.0	0.105	1.05	50 psi (3.4 Bar)

(Where X = Control Code 2,8,9).

AutoPrime™ Liquid End Configuration Data & Materials of Construction

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections
AD91 ■ AD81 ■ AD21 ■	A10HI†	1	Acrylic/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	A18HI†	1	PVC/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections
AD94 ■ AD84 ■ AD24 ■	A20HI†	2	Acrylic/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	A28HI†	2	PVC/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections
AD95 ■ AD85 ■ AD25 ■	A30HI†	3	Acrylic/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
	A38HI†	3	PVC/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections
AD96 ■ AD86 ■ AD26 ■	A40HI†	4	Acrylic/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
	A48HI†	4	PVC/PVC	Ceramic**	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.

Output Information with AutoPrime™ Liquid End — Estimated

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
ADX1	0.0015	0.15	0.006	0.6	0.095	9.5	0.008	0.079	250 psi (17.2 Bar)
ADX4	0.0033	0.33	0.012	1.2	0.21	20.8	0.017	0.17	250 psi (17.2 Bar)
ADX5	0.008	0.8	0.030	3.0	0.50	50.5	0.042	0.42	110 psi (7.6 Bar)
ADX6	0.018	1.8	0.068	6.8	1.14	113.6	0.095	0.95	50 psi (3.4 Bar)

(Where X = Control Code 2,8,9).

AUTOPRIME™ liquid ends have 3 check valves: suction on the bottom; discharge on the front; autoprime bleed on the top. By design, a repeatable portion of the process fluid continuously bleeds through the top check valve to be returned to the chemical supply. The result is the assurance that any gas in the head is automatically relieved thus eliminating air-binding. Depending on application, output may be reduced up to 50%. Variables include supplier piping, stroke length and speed setting.

■ See front page for voltage code specifications.

† To specify black, UV resistant tubing, change 'I' to 'U'. To specify head only and no 4FV, change S to N for FastPrime or change H to A for AutoPrime.
To specify 1/2" NPT Male, change "I" to "P".
To specify Ported Head, change "V" to "P".

** Autoprime™ cartridge ball is Hastelloy.

4FV indicates that the pump is equipped with an LMI Four Function Valve. This diaphragm type, anti-syphon/pressure relief valve is installed on the pump head. It provides anti-syphon protection and aids priming, even under pressure.

Fluorofilm™ is a copolymer of PTFE and PFA. Polyprel® is an elastomeric PTFE copolymer.

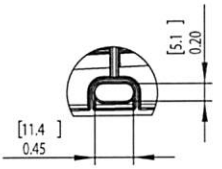
Polyprel is a registered trademark of Milton Roy, LLC.

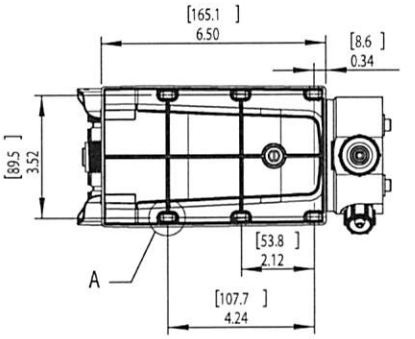
Fluorofilm and Liquifram are trademarks of Milton Roy, LLC.

Viton® is a registered trademark of E.I. du Pont Company.

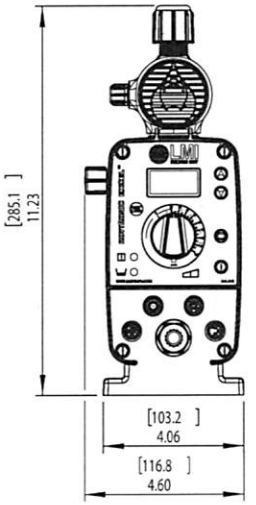
MOUNTING INFORMATION

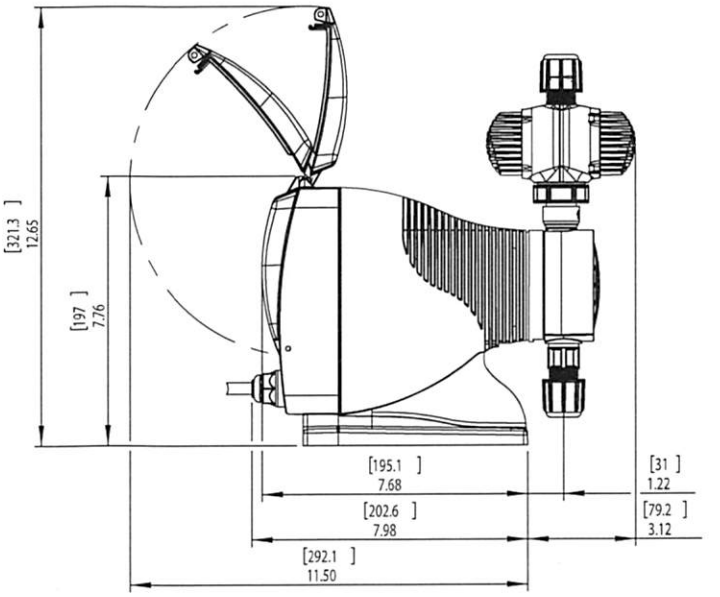
VIEW A



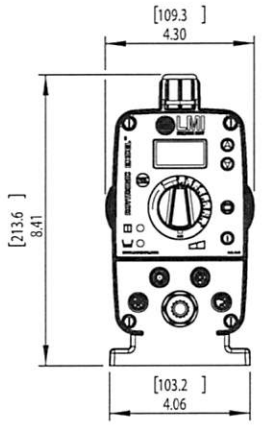


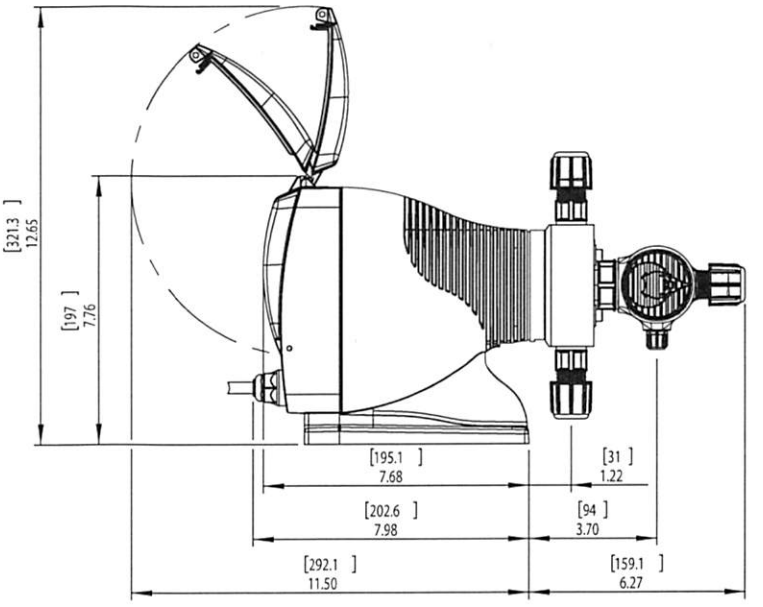
FASTPRIME LIQUID ENDS





AUTOPRIME LIQUID ENDS

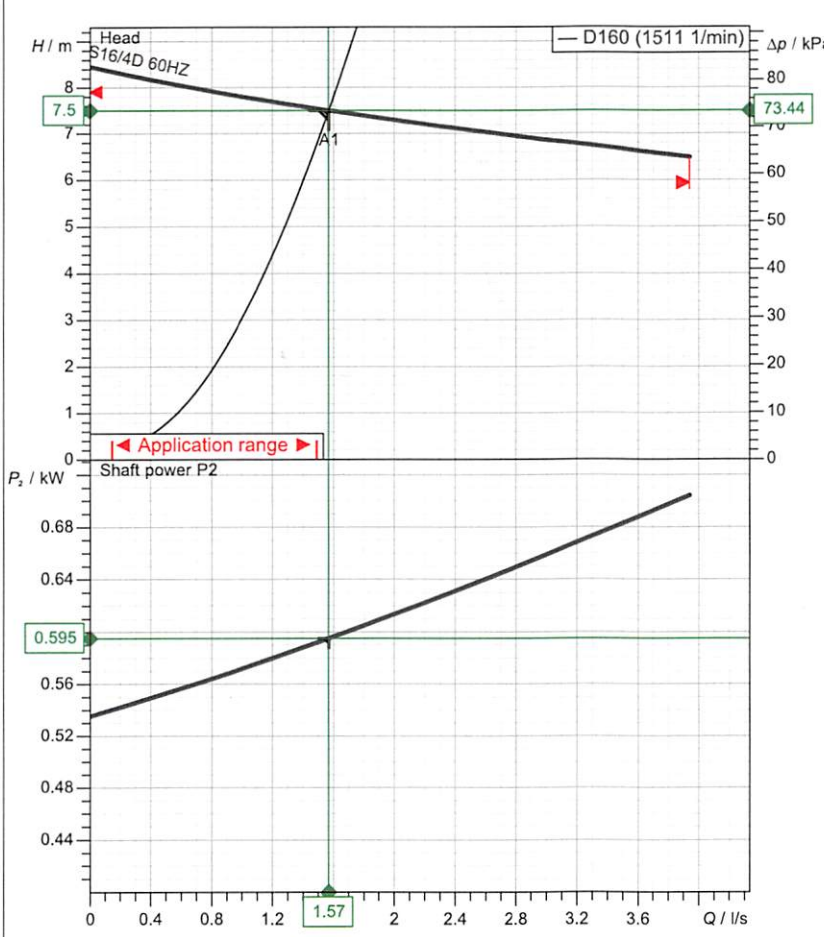




NOTE: ALL DIMENSIONS ARE IN INCHES [MM]. DIMENSIONS SHOWN ARE FOR LARGEST LIQUID END.
DIMENSIONS WILL VARY DEPENDING ON LIQUID END SELECTED.

SULZER

AS 0830 D 60 HZ



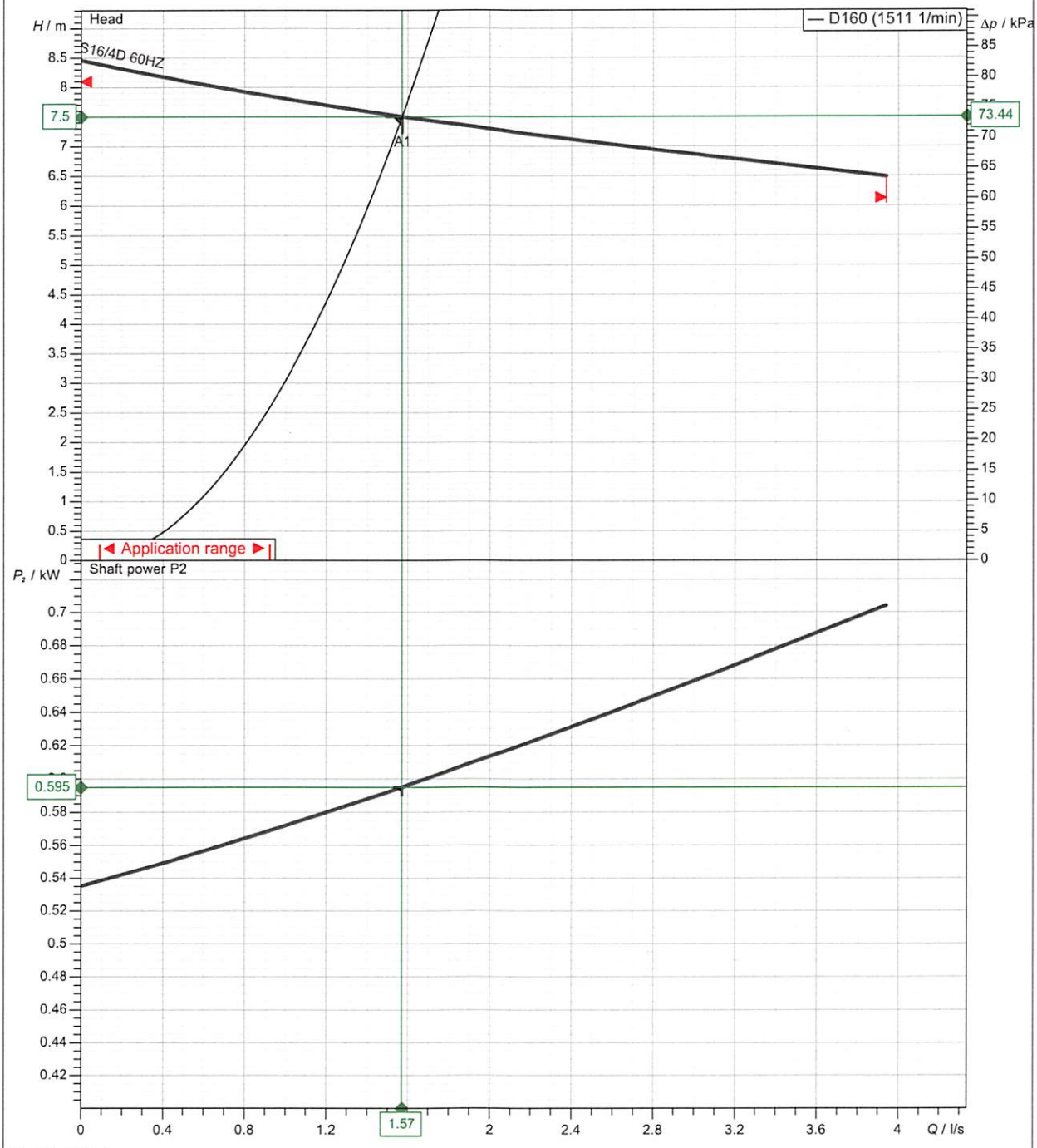
Test Standard
ISO 9906, HI 11.6/14.6≤10kW

2022-04-25

Operating data specification			
Flow	1.57 l/s	Power input	0.86 kW
Efficiency	19.4 %	Head	7.5 m
NPSH		Shaft power	0.595 kW
Temperature	20 °C	Fluid	Water
No. of pumps	1	Nature of system	Single head pump
Pump data			
Type	AS 0830 D 60 HZ	Make	SULZER
Series	AS	Impeller	Vortex impeller
N° of vanes	6	Impeller size	160 mm
Free passage	60 mm	Suction flange	
Discharge flange	DN80	Type of installation	
Moment of inertia			Wet Well Stationary
Motor data			
Rated voltage	600 V	Frequency	60 Hz
Rated power P2	1.6 kW	Nominal Speed	1620 1/min
Number of poles	4	Efficiency	71.5 %
Power factor	0.78	Rated current	2.76 A
Starting current	8.72 A	Rated torque	9.44 Nm
Starting torque	18.5 Nm	Degree of protection	IP 68
Insulation class	F	No. starts per hour	15

Curve number	Pump performance curves	SULZER
Reference curve AS 0830 D 60 HZ	**AS 0830 D 60 HZ**	

					Discharge	Frequency
					DN80	60 Hz
Density	Viscosity	Test Standard			Rated speed	Date
998.2 kg/m³	1 mm²/s	ISO 9906, HI 11.6/14.6≤10kW			1511 1/min	2022-04-25
Flow	Head	Shaft power	Power input	Rated power P2	Hyd. efficiency	NPSH
1.57 l/s	7.5 m	0.595 kW	0.86 kW	1.6 kW	19.4 %	



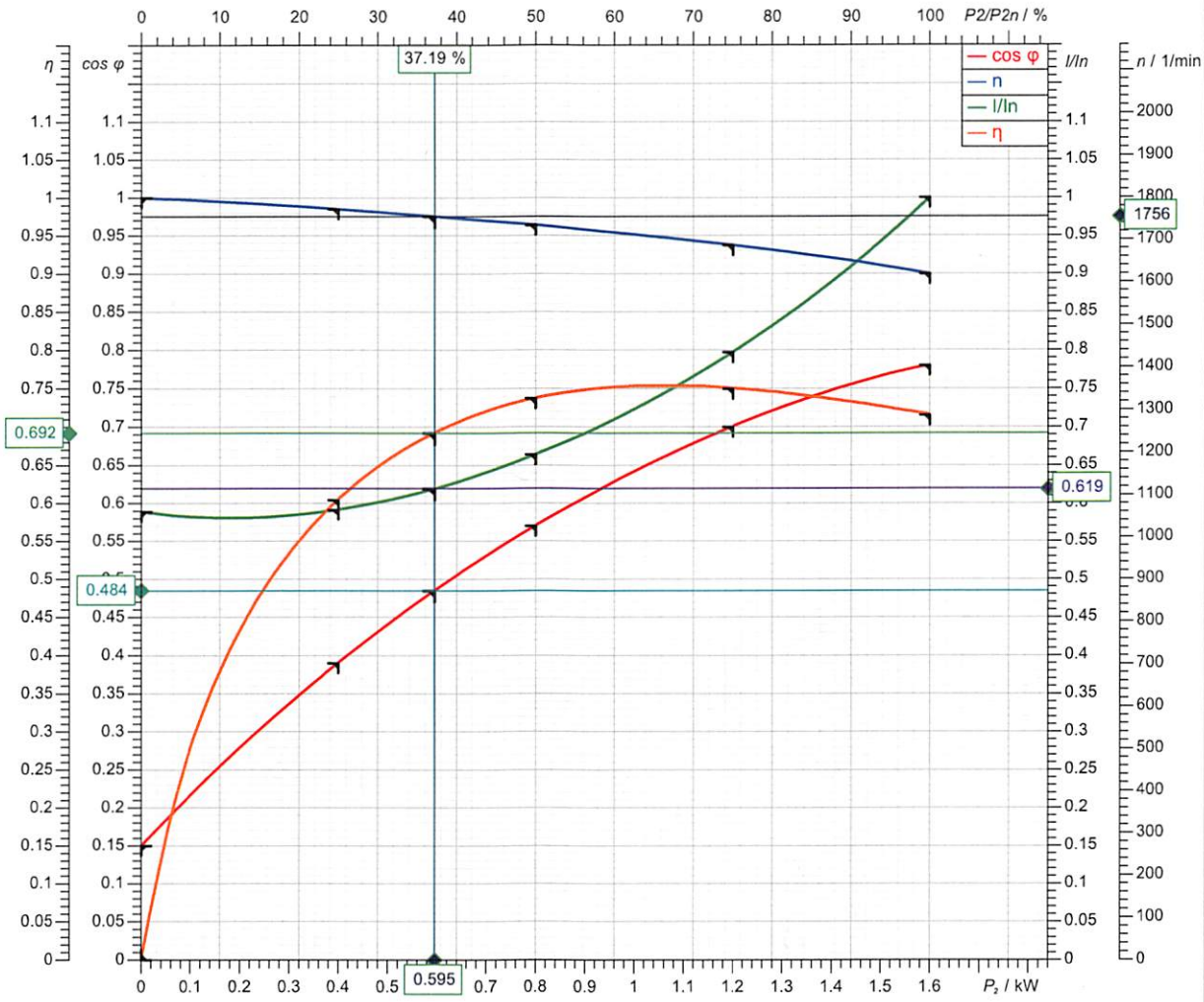
Wet Well Stationary

Impeller size	N° of vanes	Impeller	Solid size	Revision
160 mm	6	Vortex impeller	60 mm	

Spaix® 5-2021.4 - 2022/01/07 (Build 505), 64 bit
Data version April 22.1

Frequency 60 Hz		**Motor performance curve** S16/4D 60HZ	SULZER

Rated power	Service factor	Nominal Speed	Number of poles	Rated voltage	Date
1.6 kW	1	1620 1/min	4	600 V	2022-04-25



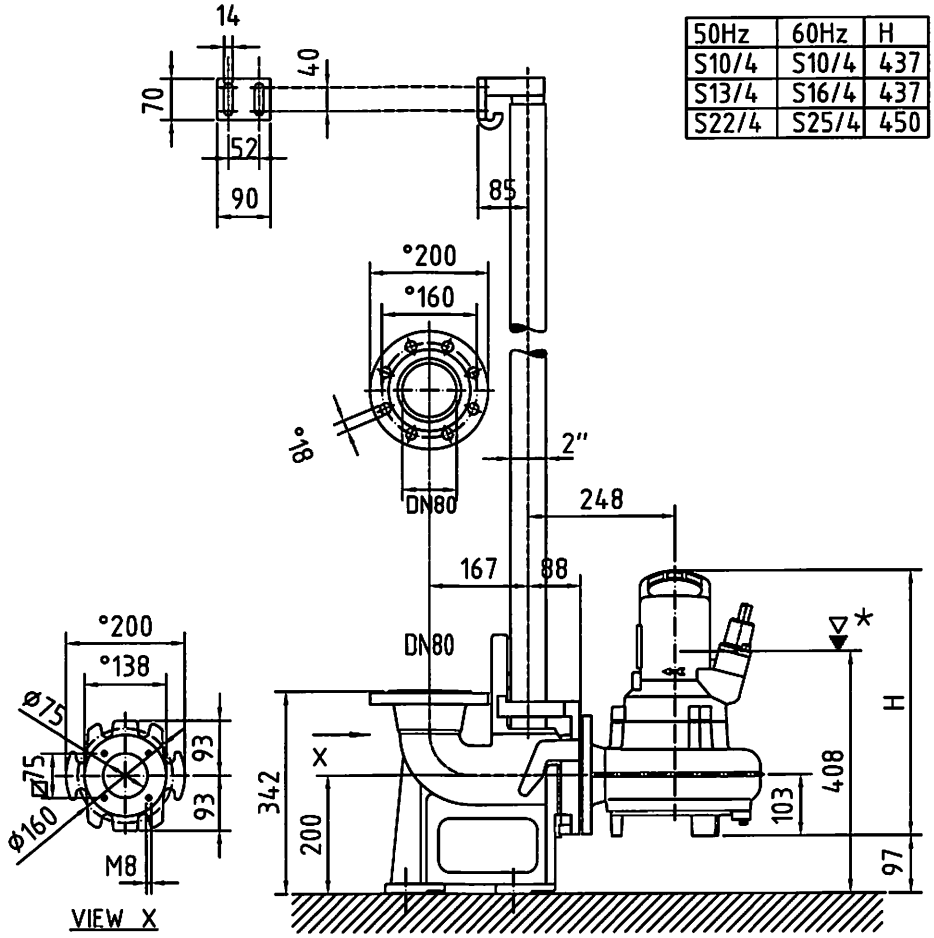
Symbol	No load	25 %	50 %	75 %	100 %	125 %
P2/ kW	0	0.4	0.8	1.2	1.6	
P1/ kW	0.2534	0.6619	1.085	1.601	2.237	
I / A	1.625	1.633	1.832	2.2	2.76	
cos s	0.15	0.39	0.57	0.7	0.78	
n / 1/min	1800	1773	1735	1687	1619	
s / %	0	1.5	3.611	6.278	10.06	
M / Nm	0	2.154	4.403	6.793	9.437	
7 / %	0	60.44	73.71	74.97	71.52	

Tolerance according to VDE 0530 T1 12.84 for rated power

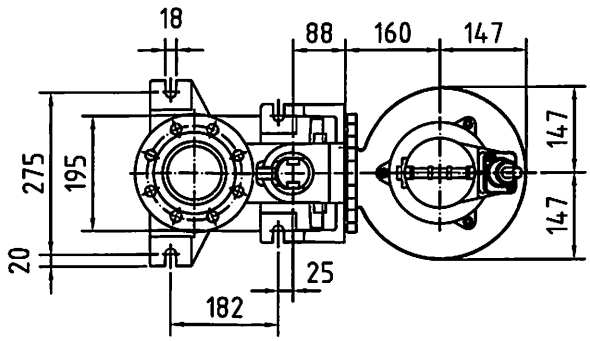
Starting current	Starting torque	Moment of inertia	No. starts per hour	
8.72 A	18.5 Nm		15	

SULZER	Massblatt AS0830 S10/4 - S25/4 Dimension sheet Plan d'encombrementt	No: AN-M 12.24 -02 Drawn: 18.07.97/C.Quirke Issue Date: 22.02.02 Änderungen vorbehalten Technical changes reserved Con riserva di modifiche Con reserva de modificaciones Sous réserve de modification

50Hz	60Hz	H
S10/4	S10/4	437
S13/4	S16/4	437
S22/4	S25/4	450



✳ LOWEST SWITCH OFF POINT FOR AUTOMATIC OPERATION



Temperature and leakage relay type ABS CA 462

SULZER

CA 462 is designed to spy and detect leakage and temperature in pumps and mixers. The amplifier is housed in a norm enclosure fitted for DIN-rail mounting. The unit is available in two executions, 24 VDC or 110-230 VAC supply. To minimize the risk of false alarms the leakage failure has to be detected for time duration of approximately 10 seconds. To simplify the mounting the unit is fitted with plug-in type of connectors.

The unit has separate alarm outputs for temperature and leakage. CA 462 also has main contactor relay output energized depending on alarm/s with manual reset option. Included in the kit is also a Xylem MiniCas adaptor.

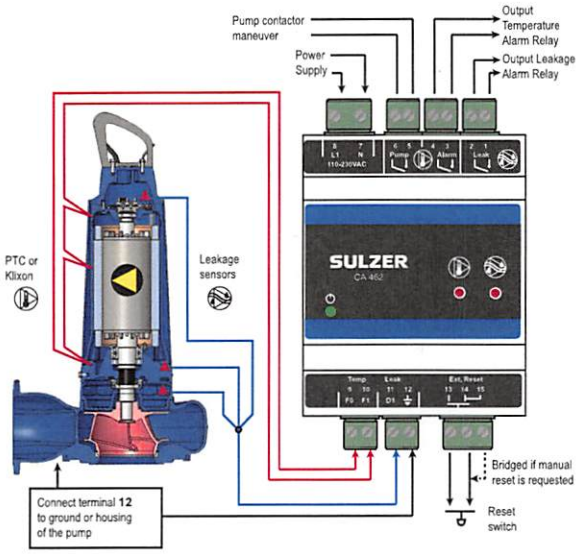
Features:

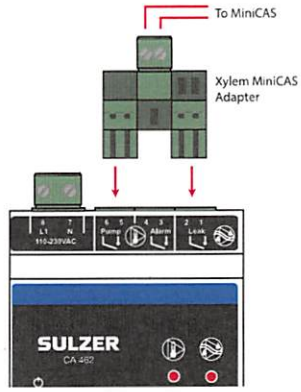
- Leakage monitoring with 10 sec alarm delay
- Temperature monitoring
- Relay output 250 VAC 3 Ampere
- Connection via plug-in connectors
- DIN-rail mounted

Technical specifications

Description		Standard
Temperature input threshold (±10%)		> 3.3 kohm (PTC / Klixon)
Max PTC current		< 0.6 mA
PTC source voltage		12 VDC
Leakage sensor voltage		12 VDC
Max leakage sensor current		< 15 µA
Leakage detection threshold (±10%)		< 100 kohms
Leakage alarm delay		10 seconds
Ambient operating temperature		-20 to +50 °C (-4 to +122 °F)
Ambient storage temperature		-30 to +80 °C (-22 to +176 °F)
Degree of protection		IP 20, NEMA: Type 1
Housing material		PPO and PC
Mounting		DIN Rail 35 mm
Installation category		CAT II
Pollution degree		2
Flame rate		V0 (E45329)
Humidity		0-95 % RH non-condensing
Dimensions		H x W x D: 108 x 70 x 58 mm (4.25 x 2.76 x 2.28 inch)
Power supply	**16907006**	110-230 VAC, 50 Hz/60 Hz
	16907007	18-36 VDC, SELV or Class 2
Fuse		Max 10 A
Terminal wire size		Use copper (Cu) wire only. 0.2 - 2.5 mm^2 flexible core, stripped length 8 mm.
Terminal tightening torque		0.56 - 0.79 Nm (5-7 lbs-in)
Power consumption		< 5 W
Max load alarm relays		250 VAC 3 Ampere resistive load
Altitude		Max 2000 MASL or 6562 ft. AMSL
Max load output pump blocking relay		250 VAC 6 Ampere resistive load
Complience		CE SP US UL

Electrical connection diagram

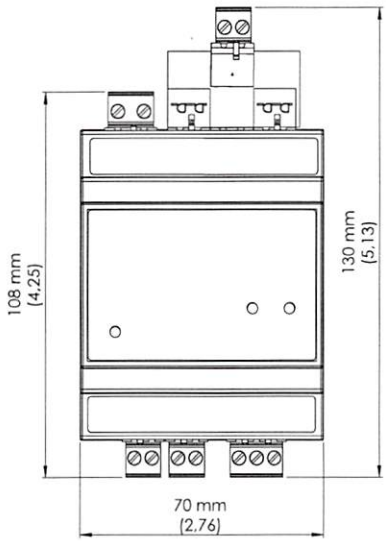


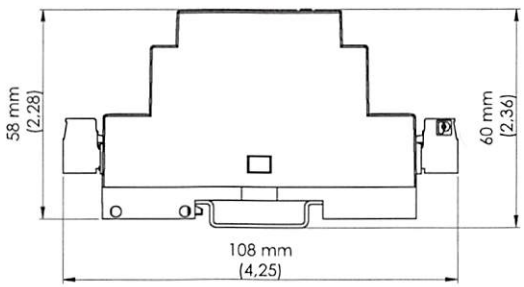


Alarm and relay function table

Alarm type	Alarm LED		Input state		Output relay state			Remark
	Temperature	Leakage	Temp (9 & 10)	Leak (11 & 12)	Pump (5 & 6)	Alarm (4 & 3)	Leak (2 & 1)	
			closed	open	closed	open	open	Normal operation
Temperature	Yes	-	> 3.3 kohm	open	open	closed	open	Pump stops
Leakage	-	Yes	closed	< 100 kohm	closed	open	closed	Pump runs
Temp. + Leak.	Yes	Yes	> 3.3 kohm	< 100 kohm	open	closed	closed	Pump stops

Dimensions





JWC Environmental Canada
2889 Norland Avenue
Burnaby, BC
Canada V5B 3A9
P: 604-291-7150
F: 604-291-7190
E: sales@ipec.ca

April 29, 2022

Project: District of Sooke WWTP Expansion
Equipment Supply and Delivery
Clarifications to General Conditions

The following clarifications are offered by JWC Environmental Canada ("Supply Contractor").

1. Add new ARTICLE "Limitation of Liability. Notwithstanding anything to the contrary in the Contract, including all documents making part thereof, in no event shall Supply Contractor be liable for loss of profit, indirect, punitive, special, incidental or consequential damages of any kind. The liability of the Supply Contractor under this Contract shall not exceed (i) the proceeds actually paid out on claims against the Supply Contractor's insurance policy, or (ii) for liability to which such insurance does not apply, 100% of the Contract Price, provided, however, the Supply Contractor shall remain liable without limit for its gross negligence or willful misconduct."

SERVICE CENTER LOCATIONS

Burnaby Factory
JWC-IPEC
2889 Norland Ave.
Burnaby, BC V5B 3A9

JWC Factory

JWC Environmental

2600 S. Garnsey Street

Santa Ana, CA 92707, USAPhone: (949) 833-3888

Manufacturing Partner Facility

SMT
650 Frith Drive
Ridgeway, VA 24148

JWC Environmental®
A Sulzer Brand

JWC Environmental Inc
2850 S. Red Hill Ave., Suite 125
Santa Ana, CA 92705
P: 949-833-3888
F: 714-242-0240
E: jwce@jwce.com

May 6, 2022

District of Sooke
2205 Otter Point Road
Sooke, British Columbia
V9Z 1J2 Canada

Attn: Paul Bohemier, Manager of Wastewater
Re: District of Sooke WWTP Upgrades 2022

Please find enclosed the originals of the Bid Bond and Undertaking of Surety letter that goes with our bid for the above referenced project. We had submitted copies of these documents with our bid because these originals were delayed in-transit and were not available when we mailed our bid.

If you have any questions, please contact Bonnie Wong at 604-291-7150.

Sincerely,

JWC ENVIRONMENTAL

Eric K. Elam
Inside Technical Sales

BID BOND

Standard Construction Document
CCDC 220 - 2002

Bond No.: MNR218802-22-02

Bond Amount: 10% of tender price

JWC ENVIRONMENTAL INC. as Principal, hereinafter called the Principal, and CHUBB INSURANCE COMPANY OF CANADA a corporation created and existing under the laws of Canada and duly authorized to transact the business of Suretyship in Canada as Surety, hereinafter called the Surety, are held and firmly bound unto

DISTRICT OF SOOKE

as Obligee, hereinafter called the Obligee, in the amount of Ten percent of tender price (10% of tender price) lawful money of Canada, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal has submitted a written bid to the Obligee, dated 6th day of May, in the year 2022 for

WWTP Expansion Equipment Supply and Delivery (IFT 2022-004) - SUPPLY AND DELIVERY OF WASTEWATER EQUIPMENT INCLUDING: ROTARY DRUM THICKENER, ROTARY DRUM THICKENER FEED PUMP, POLYMER SYSTEM, AND CONTROL PANEL

The condition of this obligation is such that if the Principal shall have the bid accepted within the time period prescribed in the Obligee's bid documents, or, if no time period is specified in the Obligee's bid documents, within Sixty (60) days from the closing date as specified in the Obligee's bid documents, and the Principal enters into a formal contract and gives the specified security, then this obligation shall be void; otherwise, provided the Obligee takes all reasonable steps to mitigate the amount of such excess costs, the Principal and the Surety will pay to the Obligee the difference in money between the amount of the bid of the Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former.

The Principal and Surety shall not be liable for a greater sum than the Bond Amount.

It is a condition of this bond that any suit or action must be commenced within seven (7) months of the date of this Bond.

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

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond dated 27th day of April, in the year 2022.

SIGNED and SEALED in the presence of

JWC ENVIRONMENTAL INC.

Signature

GREGORY B. QUEEN, PRESIDENT

Name of person signing

CHUBB INSURANCE COMPANY OF CANADA

Signature

Roxanne Villa, Attorney In Fact

Name of person signing

BOND No.: MNR218802-22-02

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

CHUBB INSURANCE COMPANY OF CANADA

(Insert Bonding Company's Name)

do hereby undertake and agree to become bound to District of Sooke for a PERFORMANCE BOND for

One Hundred Fifty Five Thousand DOLLARS ($ 155,000.00)
(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

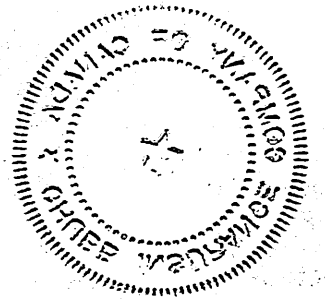
JWC Environmental Inc.
(Insert Tenderer's Name)

Dated at Sooke, British Columbia, this 29th day of April ,2022.

Yours very truly,

Signature and Corporate Seal of Surety Company Licensed to Conduct Business in the Province of British Columbia

Roxanne Villa, Attorney In Fact



.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 the 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 of Sooke

(DISTRICT)

AND:

(CONTRACTOR)

AND:

JWC Environmental Canada ULC

(SUPPLY CONTRACTOR)

WHEREAS:

A. District entered into a Contract with the Supply Contractor dated [_____], for the Supply and Delivery of Wastewater 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: _____

JWC Environmental Canada ULC

by its authorized signatory on_____day of_____, 2019:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

SUPPLEMENTARY GENERAL CONDITIONS

Contract: WWTP UPGRADE 2020

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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.

2.5.11 ***(add new article 2.5.11 as follows)***

The *Contractor* shall conduct and provide results to the *Consultant* of successful compaction tests, meeting the minimum compaction requirements of the *Contract Documents* for all import gravel under new structures and for walkways and access roads within 3 working days and prior to proceeding with additional layers of backfill and/or concrete. Minimum testing frequency to be 50m2 per 300mm depth of import gravel for the access road and the SBR, and 1 test per 10m of installed pipe for trenching. Costs for these tests to be at the *Contractor's* cost.

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 2022**

Supplementary Specifications

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

Section Number	Section Title	No. of Pages

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 infrastructure, equipment, and plant operation. Contractor is to provide a detailed tie-in and work sequencing plan within 4 weeks of project award.

.2 The connection and Work sequencing plan needs to address all aspects of the Work requirements when constructing, connecting to the existing system, testing, 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 and general operations at WWTP must always be maintained during construction with exceptions of approved shutdowns.

.2 This includes, but is not limited to:

.1 Access to the existing centrifuge room and electrical room at the west end of the site must be maintained throughout the project.

.2 Access for sludge storage bin removal vehicles must be maintained at all times. Pick ups occur approximately 3 times a week, although this is subject to variation.

1.5 CONTRACTOR LAYDOWN AND PARKING

.1 Limited space is available on site (i.e. within WWTP secured area) for contractor use for equipment storage, trailer laydown etc.

.2 Parking onsite is limited. Parking will be available on one side of the access road as long as access to the WWTP is maintained for maintenance vehicles and sludge bin removal vehicles.

1.6 TEMPORARY POWER

.1 Power is available at this site. The contractor shall familiarize themselves with the available location and specifications of power available prior to tender, and make arrangements for additional power if required.

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 9 – PAINTING

.1 Item 5 – Painting

.2 This item shall include all costs associated with the supply and installation of paintworks as per the Drawings and Specifications required to complete the Work.

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

3.6 DIVISION 22 – PLUMBING

.1 Item 6 – 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.

3.7 DIVISION 25 – INTEGRATED AUTOMATION

.1 Item 7.1 – Instruments and Control Devices and Wiring

.1 This item shall include all costs associated Instruments and Control Devices and Wiring 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.

.2 Item 7.2 – Package Equipment Wiring Interconnections

.1 This item shall include all costs associated with Package Equipment wiring interconnections 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 Item 7.3 – SCADA PLC Programming/Integration

.1 This item shall include all costs associated with SCADA and PLC Programming/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.

3.8 DIVISION 26 – ELECTRICAL

.1 Item 8.1 – 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 8.2 – Motor Control Centre

.1 This item shall include all costs associated with Motor Control Centre Supply and Installation 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 Item 8.3 – 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 (thickener discharge pump for example).

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

.4 Item 8.4 – 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.

3.9 DIVISION 31 – EARTHWORKS

.1 Item 9.1 – Excavation

.1 This item shall include all costs associated with excavation required to facilitate the work 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 9.2 – Import Fill

.1 This item shall include all costs associated with supply and install of import fill required to facilitate the work 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.

3.10 DIVISION 32 – SURFACE IMPROVEMENTS

.1 Item 10.1 – Access Road Construction

.1 This item shall include all costs associated with construction of the road structure for the access road (earthworks to be paid under Division 31) required to facilitate the work 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 10.2 – Walkway Construction

.1 This item shall include all costs associated with supply and install of the walkway around the perimeter of the SBR required to facilitate the work 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.

3.11 DIVISION 33 – SITE UTILITIES

.1 Item 11.1 – Water Piping

.1 This item shall include all costs associated with installation of water piping in accordance with MMCD Platinum Specifications, outside of the perimeter of the SBR, required to facilitate the work 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 10.2 – Sanitary Piping

.1 This item shall include all costs associated with installation of sanitary sewer piping in accordance with MMCD Platinum Specifications, outside of the perimeter of the SBR, required to facilitate the work 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.

3.12 DIVISION 40 – PROCESS INTEGRATION

.1 Item 11.1 – Process Piping and Valves and Gates

.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 11.2 – 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.

3.13 DIVISION 43 – PROCESS EQUIPMENT

.1 Item 12.1 – EQ Tank Pumps

.1 This item shall include all costs associated with the supply, installation and commissioning of the EQ Tank 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.

.2 Item 13.2 – Rotary Drum Thickener Feed Pump

.1 This item shall include all costs associated with the supply, installation and commissioning of the Rotary Drum Thickener Feed Pump 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 13.3 – Tertiary Disk Filter

.1 This item shall include all costs associated with the supply, installation and commissioning of the Tertiary Disk Filter 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

3.14 DIVISION 44 – POLLUTION CONTROL EQUIPMENT

.1 Item 14.1 – Sequencing Batch Reactor

.1 This item shall include all costs associated with the supply, installation and commissioning of the Sequencing Batch Reactor 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 14.2 – Rotary Drum Thickener

.1 This item shall include all costs associated with the supply, installation and commissioning of the Rotary Drum Thickener 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 14.3 – Polymer Feed System

.1 This item shall include all costs associated with the supply, installation and commissioning of the Polymer Feed 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. Contractor to familiarize themselves with the available power onsite and make arrangements for additional power if required.

1.5 TELEPHONE AND INTERNET

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

1.6 POTABLE WATER

.1 Potable water is available at the Work Site. Contractor to familiarize themselves with the location and specifics and make arrangements for additional water if necessary.

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 although parking Is limited.

.2 Parking will be allowed on the access road into site as long as only one side is used and access for vehicles to the WWTP site is maintained at all times. There will be a 2 week period where parking is not permitted along this section – exact dates to be confirmed.

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.

.2 In accordance with the Construction Environmental Management Plan provided as part of these specifications.

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**: Thirty (30) consecutive days of successful operation 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 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 thirty (30) successful consecutive day System Operational Test 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 (30) successful consecutive day System Operational Testing.

3.2 PREPARATION FOR SYSTEM OPERATIONAL TESTING

.1 Prior to the System Operational Test, ensure the following:

.1 Clean water, air, screened and degritted sewage, or sludge, 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 Thirty (30) days of successful and consecutive operation 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 thirty (30) successful and consecutive days 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 thirty (30) days of testing. 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.

.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 thirty (30) full days of successful operation, the actual elapsed time may be more than thirty (30) 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 thirty (30) successful and consecutive days 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 thirty (30) successful and consecutive days to prove compliance with the requirements listed in the Technical Specifications. The Commissioning period must be 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" (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 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 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 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 Thirty (30) successful and consecutive days of operation 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" (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 thirty (30) days of the Commissioning. 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.

.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, The District, Engineer and Contractor will sign the **"Certificate of Satisfactory Commissioning" (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 thirty (30) consecutive days 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 installed equipment and components under this contract.

.4 Allow at least 3 days total training for operations and maintenance staff. 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-purchased equipment.

.2 Process equipment as specified in Division 40 and 43

.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

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

1.1.1 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

1.2.1 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.

1.2.2 Ensure installation is to the satisfaction of other sections and of the Owner's Representative prior to placing concrete.

1.3 Reference Standards

1.3.1 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 2018, 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

1.4.1 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 with regard to public safety.

1.4.2 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

1.5.1 Conform to good construction practice with regards to safety.

1.5.2 Carry out concrete forms work in accordance with the British Columbia Building Code.

1.6 Qualifications

1.6.1 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

1.7.1 Submittals shall be in accordance with Section 01330 – Submittal Procedures.

1.7.2 Submit all proposed joint details, locations and construction procedures. Include waterstop, crack inducer, reglet, sealant and joint filler products as required.

1.7.3 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

1.8.1 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.

1.8.2 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.

1.8.3 Clearly indicate all pertinent dimensioning, location of reglets and reveals and tie patterns.

1.8.4 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

1.9.1 Deliver all materials to the site in bundles easily identified and properly marked.

1.9.2 Store and handle all form material on site in a manner to prevent damage and contamination.

1.10 Quality Control

1.10.1 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 2018 and Workers' Compensation Board.

1.10.2 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

2.1.1 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.

2.1.2 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.

2.1.3 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.

2.1.4 Steel forms: Minimum thickness 1.6 mm, well matched, tight fitting and adequately stiffened to support weight of concrete without deflection.

2.1.5 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.

2.1.6 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.

2.1.7 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.

2.1.8 Form ties for all liquid retaining structures; reservoirs, 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.

2.1.9 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.

2.1.10 Form Release Agent: Colourless, non-staining, non-volatile type, NSF 61 approved. For exposed concrete finishes, use low viscosity agent to eliminate bugholes.

2.1.11 Fillets for Chamfered Corners: Minimum 12 mm x 12 mm wood.

2.1.12 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.

2.1.13 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.

2.1.14 Void Protection: Wood preserved pressure treated plywood; 12 mm thick by 250 mm high each side of void form to protect void space.

2.1.15 Joint Details: Provide materials and sizes as shown on Contract Drawings.

PART 3 EXECUTION

3.1 General

3.1.1 Perform concrete formwork and falsework in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.

3.2 Formwork Erection

3.2.1 Verify lines, levels and centres before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2.2 Ensure that supplied equipment, hardware, and items to be cast-in will fit concrete dimensions.

3.2.3 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.

3.2.4 Provide bracing to ensure stability of formwork as a whole. Prop or strengthen all previously constructed elements liable to be overstressed by construction loads.

3.2.5 Arrange and assemble formwork so as to permit easy dismantling and stripping so that concrete is not damaged during its removal.

3.2.6 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.

3.2.7 Chamfer external corners and edges of beams, columns and walls 20 mm when exposed or as noted.

3.2.8 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.

3.2.9 Camber beams: 0.2% of span unless otherwise noted.

3.2.10 Camber slabs: 0.1% of span for all spans over 3 m.

3.2.11 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.

3.2.12 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.

3.2.13 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.

3.2.14 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.

3.2.15 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.

3.2.16 Form construction joints as indicated on the drawings.

3.2.17 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.

3.2.18 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.

3.2.19 Construction joint spacing in non-watertight walls and grade beams maximum 12 m or as indicated on drawings.

3.2.20 Construction joint spacing in slabs on grade maximum 24 m or as indicated on drawings.

3.2.21 Construction joints spacing in all base slabs maximum 22.5m or as indicated on drawings.

3.2.22 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.

3.2.23 Proposed construction joint locations and details to be approved by the Owner's Representative.

3.2.24 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 03300.

3.2.25 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

3.3.1 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.

3.3.2 Formwork to be in accordance with CSA-A23.1, Clause 27.

3.3.3 Allow Owner's Representative to inspect and approve each section of formwork prior to placing reinforcement.

3.3.4 Control joint and placement break spacings outlined on structural drawings are maximum allowable.

3.3.5 All horizontal and vertical joints are to result in a satisfactory symmetrical pattern approved in advance of forming by the Owner's Representative.

3.3.6 All reglets in walls and railings to also extend over top of the wall or railing.

3.3.7 Caulk or otherwise seal all form joints including corners to prevent bleeding of fines.

3.3.8 Provide reglets to forms at all vertical placement breaks and as indicated or detailed. Caulk reglet formwork to prevent bleeding of fines from concrete.

3.3.9 Replace damaged forms and forms with poor surfaces with new material as directed by the Owner's Representative.

3.3.10 Chamfer all exposed edges and corners.

3.4 Void Form

3.4.1 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).

3.4.2 Install top void form protection for structural slabs on grade.

3.5 Inserts/Embedded Parts/Openings

3.5.1 Provide formed openings where required for pipes, conduits, sleeves and other work to be embedded in and passing through concrete members.

3.5.2 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.

3.5.3 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.

3.5.4 Provide recesses in top of foundation walls at all doors and openings to allow slab to bear on walls.

3.5.5 Accurately locate and set in place items that are to be cast directly in concrete.

3.5.6 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.

3.5.7 Do not place anchor bolts, sleeves and inserts into freshly placed concrete. Tie firmly into place prior to placing concrete.

3.5.8 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.

3.5.9 Ensure all waterstops are continuous and properly installed and sealed watertight.

3.5.10 Ensure all waterstop are securely fastened to prevent folding during concrete placement.

3.5.11 Ensure all openings for pipes or sleeves through liquid retaining structures properly address watertight requirements.

3.6 Cleaning Forms

3.6.1 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.

3.6.2 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.

3.6.3 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

3.7.1 Comply with CSA-S269.1 for dismantling all falsework.

3.7.2 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.

3.7.3 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.

3.7.4 Arrange forms to allow removal without removal of principal shores where these are required to remain in place.

3.7.5 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.

3.7.6 Verify strength by field cylinders or insert type tests in accordance with ASTM C900-T.

3.7.7 Remove formwork progressively and in accordance with code requirements so that no shock loads or unbalanced loads are imposed on structure.

3.7.8 Loosen forms carefully. Do not damage concrete by wedging pry bars, hammers or tools against concrete surfaces.

3.7.9 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

3.8.1 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.

3.8.2 Certify that all formwork, shoring and components are capable of supporting all the construction loads and forces required to complete the cast-in-place concrete work.

3.8.3 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

1.1.1 Include all concrete accessories required for construction of reinforced concrete elements including anchors, pins, plates, inserts, sleeves, etc as shown on Contract Drawings.

1.1.2 Payment Fabrication, procurement installation, including all material and labour, shall be considered incidental to concrete placement.

1.2 Reference Standards

1.2.1 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 2018, “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

1.3.1 Abide by the current bylaws and regulations of the province, Town and/or Municipality in which the work is located and abide by the current laws and regulations with regard to public safety.

1.3.2 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

1.4.1 Conform to good construction practice with regard to safety.

1.4.2 Carry out concrete accessories work in accordance with the British Columbia Building Code.

1.5 Submittals

1.5.1 Submit data on all concrete accessories specified or proposed.

1.5.2 Submit all proposed joint details, locations and construction procedures. Include waterstop, crack inducer, reglet, sealant and joint filler products as required.

1.5.3 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

1.6.1 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.

1.6.2 Clearly indicate all pertinent dimensioning, arrangements and locations of concrete accessories.

1.7 Sample Panels

1.7.1 Provide concrete accessories for placement in a sample formwork panel for each architectural concrete surface receiving special treatment, painted finish or exposed finish as a result 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.

1.7.2 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

1.8.1 Deliver all materials to the site in bundles easily identified and properly marked.

1.8.2 Store and handle all material on site in a manner to prevent damage and contamination.

1.9 Quality Control

1.9.1 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

1.10.1 The Contractor is to ensure drilled anchors are tested by a testing firm certified in accordance with CSA-A283.

1.10.2 An independent testing firm may be retained and paid for by The Owner and approved by the Owner's Representative in accordance with Section 01400 of this specification.

1.10.3 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.

1.10.4 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.

1.10.5 Test anchors to 150% of the greater tension working load indicated on the drawings or as specified by the manufacturer.

1.10.6 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.

1.10.7 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.

1.10.8 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

2.1.1 Expansion Joints: Eva-Cap.

2.1.2 Expansion Joint Compression Seals: Hydrozo Jeena Seal.

2.2 Waterstop

2.2.1 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

2.3.1 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

2.4.1 Joint Sealant: Provide materials and sizes as shown on the Contract Drawings.

2.5 Drilled Anchors

2.5.1 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 HY150 grout or ITW Ceramic 6 grout as indicated on drawings. Use standard embedment depths per Hilti HY150 grouting system.

PART 3 EXECUTION

3.1 General

3.1.1 Perform concrete accessories work in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.

3.2 Formwork Erection

3.2.1 Ensure that supplied accessories, hardware, and items to be cast-in will fit concrete dimensions.

3.2.2 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.

3.2.3 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

3.3.1 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.

3.3.2 Allow Owner's Representative to inspect and approve accessories placed in formwork prior to placing concrete.

3.3.3 Ensure that reglets to be placed in formwork are acceptable for joint sealants.

3.3.4 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

3.4.1 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.

3.4.2 Install stair nosing centered on all concrete stairs in accordance with the manufacturer's written recommendations.

3.4.3 Install waterstops continuous without displacing reinforcement. Do not nail through waterstops. Heat seal all joints watertight.

3.4.4 All joints except straight butt joints to be fabricated by the manufacturer in the manufacturer's shop.

3.4.5 Wire all waterstop to reinforcing to prevent folding during concrete placement.

3.5 Placing Concrete

3.5.1 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.

3.5.2 Ensure all accessories and hardware, inserts, embedded parts, formed expansion and contraction joints and other critical items are not disturbed during concrete placement.

3.5.3 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

3.6.1 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

1.1.1 Supply and place steel reinforcement shown or otherwise indicated on Contract Drawings.

1.1.2 Payment Fabrication, procurement installation, including all material and labor, shall be considered incidental to concrete placement.

1.2 Work Installed but Supplied under Other Sections

1.2.1 Install materials specified to be supplied under other sections of these specifications.

1.2.2 Ensure installation is to the satisfaction of sections concerned and of the Owner's Representative prior to placing concrete.

1.3 Reference Standards

1.3.1 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 2018, "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

1.4.1 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 with regard to public safety.

1.4.2 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

1.5.1 Conform to good construction practice with regards to safety.

1.5.2 Carry out concrete reinforcement work in accordance with the British Columbia Building Code.

1.6 Submittals

1.6.1 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.

1.6.2 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

1.7.1 Submit shop drawings of reinforcing steel in accordance with Section 01330.

1.7.2 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.

1.7.3 Use large scale details for areas of congested reinforcement.

1.7.4 Support and placing details of reinforcing to ACI 315 and RISC.

1.8 Delivery, Storage and Handling

1.8.1 Deliver all materials to the site in bundles easily identified and properly marked.

1.8.2 Store and handle all material on site in a manner to prevent damage and contamination.

1.8.3 Do not straighten or re bend any reinforcement.

1.8.4 Do not use any reinforcement that has been kinked or bent on site.

1.9 Quality Control

1.9.1 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

1.10.1 The Contractor is to ensure concrete reinforcement is tested by a qualified testing firm.

1.10.2 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.

1.10.3 Provide casual labor 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.

1.10.4 Provide samples of reinforcement as delivered to the site for testing if requested.

1.10.5 The Contractor is to inspect and test all concrete reinforcement work to ensure compliance with the Contract Documents.

1.10.6 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

2.1.1 Reinforcing steel: To CAN/CSA G30.18, 400 MPa yield grade deformed billet steel bars.

2.1.2 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. Grade 400W is to be used where bars are bent and where bars are galvanized to CAN/CSA G164 as detailed.

2.1.3 Welded steel wire fabric: To CSA G30.5, flat sheets.

2.1.4 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.

2.1.5 Slab on grade chairs and bar supports: Precast concrete of correct height. Metal pipe, stone or wood are not acceptable.

2.1.6 Tie wire: Minimum 1.6 mm annealed type or patented system approved by the Owner's Representative.

2.1.7 Mechanical splices at locations where reinforcing cannot be lap spliced for compression as for full tension.

2.2 Fabrication of Concrete Reinforcement

2.2.1 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.

2.2.2 Verify dimensions of existing work prior to commencing fabrication.

2.2.3 Verify all drawing dimensions and conditions prior to commencing fabrication.

2.2.4 Bend all reinforcement cold unless otherwise approved by the Owner's Representative.

2.2.5 Provide column and wall dowels from foundations and base slabs using same reinforcing as in columns and walls unless noted otherwise on the drawings.

2.2.6 Provide all additional support bars as required to support all main reinforcement indicated.

2.2.7 Provide stirrup support bars sized to match stirrup size in hooks or corners of beam stirrups unless noted otherwise on drawings.

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

2.2.9 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.

2.2.10 Locate reinforcing splices not indicated on drawings at points of minimum stress. Location of splices is to be approved by the Owner’s Representative.

2.2.11 Refer to structural drawings for minimum splices. Splice lengths as indicated on the drawings.

2.2.12 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.

2.2.13 Test all welded reinforcement splices unless noted.

2.2.14 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.

2.2.15 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

3.1.1 Perform concrete reinforcement work in accordance with requirements of CSA A23.1 unless indicated otherwise on the drawings.

3.2 Placing Reinforcing Steel

3.2.1 Place reinforcing steel in accordance with CSA A23.1, Clause 12.

3.2.2 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.

3.2.3 Place and secure all reinforcement in its correct position prior to placing any concrete. Do not adjust or place reinforcement in freshly placed concrete.

3.2.4 Reinforce around openings as noted on structural drawings.

3.2.5 Supply and place all necessary support accessories, whether specifically detailed or not, to ensure proper placement of reinforcing steel.

3.2.6 Use non-corrosive or non-stain supports for reinforcing when concrete is exposed.

3.2.7 Support slab on grade, structural slab, foundation and base slab reinforcement at 900 mm maximum on centre.

3.2.8 Supply bar support chairs for top reinforcing bars in sufficient quantity to not exceed 900 mm average spacing in each direction.

3.2.9 Supply chairs to support temperature reinforcing or mesh to maintain minimum covers specified.

3.2.10 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.

3.2.11 Supply horizontal reinforcing spacers in walls to ensure reinforcing does not move during placement.

3.2.12 Support reinforcement laterally in pairs on opposite faces of walls, columns and beams.

3.2.13 Provide minimum concrete cover to reinforcing steel as indicated on the drawings.

3.2.14 Do not re bend or straighten reinforcing steel after initial fabrication unless so indicated on the drawings.

3.2.15 Ensure reinforcing is clean, free of loose scale, dirt, oil, rust and other foreign coatings.

3.2.16 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.

3.2.17 Place reinforcing for slab on grade on precast concrete chairs or other approved supports at correct height.

3.2.18 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

1.1.1 Supply and place concrete shown or otherwise indicated on Contract Drawings.

1.2 Work Installed but Supplied under Other Sections

1.2.1 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.

1.2.2 Ensure installation is to the satisfaction of sections concerned and to the Owner's Representative prior to placing concrete.

1.3 Reference Standards

1.3.1 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 2018, "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

1.4.1 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 with regard to public safety.

1.4.2 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

1.5.1 Conform to good construction practice with regard to safety.

1.5.2 Carry out cast-in-place concrete work in accordance with the British Columbia Building Code.

1.6 Submittals

1.6.1 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.

1.6.2 Submit data to confirm compatibility of all proposed admixtures with the proposed Portland Cements and supplementary cementing materials.

1.6.3 Submit data sheets for all proposed pre-mixed grouts to the Owner's Representative for review.

1.6.4 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.

1.6.5 Submit all proposed saw cut and joint details, locations and construction procedures. Include waterstop, crack inducer, reglet, sealant and joint filler products as required.

1.6.6 Submit all proposed curing procedures and product data sheets.

1.6.7 Submit proposed methods of protection of concrete when air temperatures are expected to be above 25°C or below 5°C.

1.6.8 Submit proposed procedures for applying separate bonded topping.

1.6.9 Submit details of the proposed bonding system for bonded topping and construction joints.

1.6.10 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.

1.6.11 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

1.7.1 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

1.8.1 The Contractor is to ensure all concrete is tested by a testing firm certified in accordance with CSA-A283.

1.8.2 An independent testing firm will be retained and paid for by the Contractor in accordance with Section 01400 of these specifications.

1.8.3 The Contractor is responsible to test all concrete to ensure concrete work conforms to the requirements of the Contract Documents.

1.8.4 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.

1.8.5 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.

1.8.6 The Contractor is to inspect and test all cast-in-place concrete work to ensure compliance with the Contract Documents.

1.8.7 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.

1.8.8 Testing firms are to conduct all tests in accordance with CSA-A23.2.

1.8.9 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.

1.8.10 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.

1.8.11 Testing firms are to take a minimum of five (5) test cylinders for a strength test.

1.8.12 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.

1.8.13 Testing firms are to moist cure and test one (1) cylinder in 7 days, two (2) cylinders in 28 days and the remaining two (2) cylinders in 56 days.

1.8.14 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.

1.8.15 Testing firms are to take at least one slump test and one air content test for each set of test cylinders taken.

1.8.16 The testing firm is to take one slump test and one air test for every third load of concrete placed for liquid retaining structures.

1.8.17 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.

1.8.18 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.

1.8.19 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.

1.8.20 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.

1.8.21 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.

1.8.22 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

1.9.1 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 take into account AAR durability as per guidelines in CSA-A23.2 method 27A.

1.9.2 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.

1.9.3 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.

1.9.4 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.

1.9.5 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

1.10.1 All clauses pertaining to inspection and testing of concrete contained in this specification are to apply to unit masonry concrete unless noted otherwise.

1.10.2 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.

1.10.3 Reject and do not place job site-mixed masonry concrete over 1.5 hours from mixing time.

1.11 Inspection and Testing of Grout

1.11.1 The Contractor is to ensure all grout is tested by a testing firm certified in accordance with CSA-A283.

1.11.2 An independent testing firm will be retained and paid for by The Contractor and approved by the Owner's Representative in accordance with Section 01400 of these specifications.

1.11.3 The Contractor is responsible to test all grout to ensure grout work conforms to the requirements of the Contract Documents.

1.11.4 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

1.12.1 The Contractor is to ensure the tensile bond between topping and substrate is tested by a certified testing firm.

1.12.2 An independent testing firm will be retained and paid for by The Contractor and approved by the Owner's Representative in accordance with Section 01400 of these specifications.

1.12.3 The Contractor is responsible to test all bond strength to ensure bond strength conforms to the requirements of the Contract Documents.

1.12.4 Test bond strength in accordance with CSA Test Method A23.2-6B.

1.12.5 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

1.13.1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.

1.13.2 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.

1.13.3 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.

1.13.4 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.

1.13.5 Revise mix design proportions as required for the remainder of the work.

1.13.6 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.

1.13.7 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

2.1.1 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 in excess of 0.6% by mass.

2.2 Supplementary Cementing Material

2.2.1 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

2.3.1 For all concrete mix types, the fine aggregates are to conform to the requirements identified in CSA-A23.1 for the specified exposure class.

2.3.2 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.

2.3.3 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

2.4.1 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

2.5.1 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.

2.5.2 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.

2.5.3 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

2.6.1 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.

2.6.2 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.

2.6.3 Use only such materials or blends of materials that will result in a uniform colour of exposed surfaces.

2.6.4 Design concrete mixes that will be placed by concrete pump for pumping.

2.6.5 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.

2.6.6 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.

2.6.7 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	Water Retaining Structures	35	HS	0.40		A1	20	75	125	5 to 8	3
Type B	Sidewalks, landings	32	MS	0.45	25%	C2	20	60	100	5 to 8	1
Type C	Underside duct, enclosure/fill	10	GU	0.55	25%	N	20	60	100	-	1

Notes:

1. HS = Type 50; 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.

2.6.8 Aggregate size specified is the maximum nominal size.

2.6.9 Cement: Use Type GU, MS, and HS for all concrete.

2.6.10 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.

2.6.11 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.

2.6.12 Slump: No slumps outside the range of maximum or minimum will be permitted without written permission of the Owner's Representative.

2.6.13 Air Content: All mix types with exposure classifications to be air-entrained in accordance with the above table and CSA-A23.1.

2.6.14 Use a water-reducing agent in all concrete.

2.6.15 Do not change concrete mix proportions or source material for concrete without written approval of the Owner's Representative.

2.6.16 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.

2.6.17 Do not use calcium chloride or admixtures containing calcium chloride in any concrete.

2.6.18 Use set-retarding admixtures during hot weather with written approval of the Owner's Representative to prevent cold joints in concrete.

2.6.19 Use all admixtures in strict accordance with the manufacturer's recommendations.

2.6.20 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.

2.6.21 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

2.7.1 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 at all times 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.

2.7.2 All aggregates are to be handled so as 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

2.8.1 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.

2.8.2 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.

2.8.3 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

2.9.1 Liquid membrane-forming curing compound: To ASTM C309. Must be compatible with dustproofing and hardening agents, floor hardeners and any sealers or waterproofing used.

2.9.2 Membrane Curing Compound - Sealtight 1220, white pigmented curing compound by Meadows.

2.9.3 Monomolecular Film – Confilm by Master Builders Technologies. Use mixture of one part Confilm to five parts water.

2.10 Hardeners

2.10.1 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

2.10.2 Use non-metallic surface hardener for top surface of all floor slabs of Service Areas, Pumphouses, Tunnels and Lower Levels.

2.10.3 Apply surface hardeners in strict accordance with the manufacturer's recommendations and cure concrete as specified herein.

2.10.4 Do not use surface hardeners on concrete with air entrainment contents greater than 3%.

2.10.5 Follow the manufacturer's recommendations when using surface hardeners on concrete containing fly ash or slag.

2.11 Sealers:

2.11.1 Silane Floor Sealer: Cappar Capseal U, Masterseal SL silane sealers containing a minimum of 40% solids by weight. Use on exterior exposed slabs.

2.11.2 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

2.12.1 Sandblast sand: Fine granular material, hard, strong durable mineral particles conforming to CSA-A179.

2.12.2 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

2.13.1 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.

2.13.2 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.

2.14 Waterproofing

2.14.1 Cementitious waterproofing.

.1 Cem-Kote Flex ST by Gemite Products Inc.

PART 3 EXECUTION

3.1 General

3.1.1 Perform cast-in-place concrete work in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.

3.2 Placing Concrete

3.2.1 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.

3.2.2 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.

3.2.3 Do not place concrete against frozen ground, frozen concrete or frosted forms.

3.2.4 Place concrete in accordance with CSA-A23.1 and as specified herein.

3.2.5 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.

3.2.6 Ensure all hardware and all other items to be cast into concrete are placed securely and will not cause undue hardship in placing concrete.

3.2.7 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.

3.2.8 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.

3.2.9 Placing Concrete at Expansion Joints:

.1 Ensure joints are properly dimensioned and prepared as indicated on drawings.

3.2.10 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 as per Section 07135.

.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.

3.2.11 Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints and other critical items are not disturbed during concrete placement.

3.2.12 Revise, re-seat and correct improperly positioned reinforcing hardware and other embedded items immediately before concrete placement.

3.2.13 Ensure specified concrete cover around reinforcing is maintained.

3.2.14 Do not place concrete older than 2 hours from batch time.

3.2.15 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.

3.2.16 Place concrete and screed in accordance with the lines and levels indicated on the drawings. Note special finish concrete tolerances indicated on the drawings.

3.2.17 Place concrete in approximate horizontal layers such that each lift can be vibrated into the previous lift.

3.2.18 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.

3.2.19 Place concrete directly into its final position in forms. Do not spread concrete with vibrators.

3.2.20 Compact concrete thoroughly by mechanical vibrators. Ensure concrete is worked around reinforcement, embedded items and into all areas and corners of forms.

3.2.21 Use internal vibrators in all sections that are sufficiently large, and supplement with external type in the event that satisfactory surfaces can not be obtained.

3.2.22 Check and re-adjust formwork to required lines and levels during placement of concrete.

3.2.23 Place concrete as a continuous operation, stopping only at construction joints.

3.2.24 Allow a minimum of three days between adjacent concrete placements.

3.2.25 Place concrete in liquid-retaining structures with extreme care and extra effort.

3.2.26 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.

3.2.27 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.

3.2.28 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.

3.2.29 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

3.3.1 Limit length of concrete placement to prevent cold joints.

3.3.2 Do not place concrete from one end for full height of placement.

3.3.3 Use sufficient vibration equipment and methods to ensure dense, smooth concrete lines and surfaces free from bugholes, honeycombs and cold joints.

3.3.4 Ensure vibrator penetrates each layer of fresh concrete to prevent stratification.

3.3.5 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

3.4.1 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.

3.4.2 Remove all dust from the prepared surface by first using water then vacuuming after the surface is dry.

3.4.3 Contact the Owner's Representative for inspection of the prepared surface immediately prior to application of the bonding system.

3.4.4 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.

3.4.5 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.

3.4.6 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.

3.4.7 Start placement of topping at centre and work to outside in 300 mm sections at a time.

3.4.8 Finish and moist-cure topping or benching as specified in other clauses. Any joints in the substrate are to be matched in the topping.

3.4.9 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

3.5.1 Finish flatwork in accordance with timing and procedures outlined in CSA-A23.1.

3.5.2 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.

3.5.3 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.

3.5.4 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.

3.5.5 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.

3.5.6 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.

3.5.7 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.

3.5.8 Broomed Finish: For all exterior concrete slabs to have non-slip surfaces, final finish surface after trowelling with fine broom finish.

3.5.9 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.

3.5.10 Floor Hardeners: Apply in strict accordance with the manufacturer's recommendations to surface of all slabs.

3.6 Curing and Protection

3.6.1 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.

3.6.2 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.

3.6.3 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.

3.6.4 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.

3.6.5 Protect concrete from sudden temperature changes as noted in CSA-A23.1.

3.6.6 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.

3.6.7 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.

3.6.8 Where curing compounds are approved, apply in two applications at right angles to each other.

3.6.9 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.

3.6.10 Protect freshly placed and consolidated concrete against damage or defacement from curing methods or adverse weather conditions.

3.6.11 Exterior concrete to be properly cured and protected and allowed to air dry for 30 days prior to application of de-icing chemicals.

3.6.12 Exposed concrete walking surfaces not to receive an integral hardener: Coat with curing compound of type that provides permanent seal.

3.6.13 During hot weather, begin curing process immediately after finishing. Use continuous water application or absorptive mats.

3.6.14 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

3.7.1 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 entirely surrounding it are to be wetted to a saturated surface-dry condition to prevent absorption of water from the repair material.

3.7.2 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.

3.7.3 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.

3.7.4 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.

3.7.5 Watertight structures with honeycombing or embedded debris are not acceptable. Remove and replace concrete between construction joints.

3.7.6 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

3.8.1 Finish concrete in accordance with CSA-A23.1. Ensure all concrete finishes are uniform.

3.8.2 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.

3.8.3 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.

3.8.4 Sack-Rubbed Finish: Vertical concrete surfaces exposed to view unless sandblasted including tunnel, pumphouses, service areas, stairs. 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.

3.8.5 Do not parge.

3.8.6 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

3.9.1 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.

3.9.2 All formed surfaces are to receive as a minimum a Class 1 finish. Other finishes are to be as indicated in the specifications.

3.9.3 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.

3.9.4 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 of 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.

3.9.5 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.

3.9.6 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.

3.9.7 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 so as 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.

3.9.8 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

3.10.1 Mix to flowable consistency, and apply in accordance with manufacturer's instructions.

3.10.2 Install epoxy grout in all exterior handrail, davit and equipment base plates during erection.

3.10.3 Install dry pack grout as required under column and beam base plates.

3.10.4 Install non-shrink grout as required under columns, beams and equipment pads, and for doweling to existing concrete.

3.11 Sealers

3.11.1 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

3.12.1 Refer to Section 07900 for Joint Sealants.

3.12.2 Seal base of all form tie holes in exposed concrete surfaces using non-shrink grout or cementitious waterproofing.

3.12.3 Place cementitious waterproofing in below-grade and liquid retaining structure wall construction joint reglets.

3.13 Sandblasting

3.13.1 Conform to the requirements of the Portland Cement Association for sandblasting of concrete surfaces.

3.13.2 Use only competent and qualified workers experienced in sandblasting techniques with adequate plant and equipment.

3.13.3 Protect from damage all surfaces not scheduled for sandblast finish. Make good any damaged surfaces to the satisfaction of the Owner's Representative.

3.13.4 Hoard around work area and prevent air-borne products from contaminating or damaging new construction or other existing work.

3.13.5 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.

3.13.6 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

3.14.1 Do not core concrete without prior written approval of the Owner's Representative.

3.14.2 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

3.15.1 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.

3.15.2 Provide positive ventilation during the 12 hours preceding the start of concreting.

3.15.3 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 Testing of Watertightness of Concrete Structures

3.16.1 Do not proceed with the watertightness test until the concrete structure is completed and the concrete has attained the specified 28 day strengths.

3.16.2 Do not backfill around structures or apply gasproofing membranes, damproofing, membrane waterproofing, masonry, veneers or joint sealants until leakage and gas tests have been successfully completed.

3.16.3 Reservoir must pass water tightness test prior to backfilling

3.16.4 Supply and dispose of, off site, all potable water required for testing the wet wells at the Contractor's expense.

3.16.5 Leave for 96 hours prior to testing for leakage.

3.16.6 Measure any loss of water or leakage during the next 24 hour period.

3.16.7 The Owner's Representative will calculate allowances for evaporation from open tanks on the basis of field conditions during testing.

3.16.8 Where permissible, an allowable leakage is to be measured as a drop in the water elevation over the 24 hour period and will be determined based on actual service intended for the structure being tested. The allowable leakage for the respective structure is to be in accordance with the table following.

3.16.9 Maximum allowable leakage for the various structures is tabulated as follows:

Item	Maximum Allowable Leakage in a 24 Hour Period
Liquid retaining structures	Nil

3.16.10 No leakage or sweating whatsoever of the structure adjoining or forming part of the tunnels or pumphouses will be permitted. All liquid retaining structures are to be completely watertight.

3.16.11 Empty structure, examine, locate and repair all defects and leaks at Contractor's expense.

3.16.12 Repair all cracks in accordance with Section 2.13 (Crack Injection). Make structures completely watertight with no visible leaks at Contractor's expense.

3.16.13 Re-test structure at Contractor's expense after repairing until leakage is less than maximum specified.

3.16.14 Place sealants after all requirements for watertightness have been met as noted on the drawings.

3.16.15 Watertightness testing schedule:

.1 Perform tests on individual tanks to ensure that all walls including interior walls and slabs are subjected to liquid on one side only to confirm watertightness of each wall or slab.

.2 Schedule and perform tests such that all individual tanks, chambers, and channels are tested for watertightness.

3.16.16 Test and ensure watertightness for all concrete structures designed to hold water; channels, chambers, wet wells and tanks.

3.17 Cleaning

3.17.1 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.

3.17.2 Hose down sandblasted surfaces. Brush thoroughly with a stiff broom to remove all dust and loose particles.

3.18 Disinfection

3.18.1 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.

3.18.2 Chlorine

.1 Use liquid chlorine, sodium hypochlorite or calcium hypochlorite

.2 Refer to AWWA-B300 and B301 Standards for Hypochlorites and Liquid Chlorine.

3.18.3 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.

3.18.4 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.

3.18.5 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 Section Includes

1.1.1 Work of this Section includes, but is not limited to Concrete floor finishes.

1.2 Related Sections

1.2.1 Cast-in-Place Concrete: Section 03 30 00.

1.3 References

1.3.1 ASTM Standards:

.1 ASTM E1155-96(2008): Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

.2 ASTM E1155M-96(2008): Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers [Metric].

.3 ASTM E1486-98(2004): Standard Test Method for Determining Floor Tolerances Using Waviness, Wheel Path and Levelness Criteria.

.4 ASTM E1486M - 98(2004): Standard Test Method for Determining Floor Tolerances Using Waviness, Wheel Path and Levelness Criteria [Metric].

.5 ASTM F1869-04: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.3.2 Canadian Standards Association (CSA):

.1 CAN/CSA-A23.1/A23.2-14: Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.4 Quality Assurance

1.4.1 Do concrete finishing work in accordance with CSA-A23.1 except where specified otherwise.

1.4.2 Carry out work of this Section using an established floor finishing company having a proven record of satisfactory workmanship for a period of at least five years prior to this contract.

1.4.3 Work that is judged by the Consultant to be below an acceptable standard is to be demolished and rebuilt should the Consultant so direct.

1.5 Submittals

1.5.1 Submit MSDS sheets for curing compounds.

PART 2 PRODUCTS

2.1 Materials

2.1.1 Concrete materials: conform to Section 03 30 00.

2.1.2 Curing Compound: Zero VOC concrete curing compound, BASF "Masterkure 200W" or preapproved product.

PART 3 EXECUTION

3.1 Inspection

3.1.1 Inspect surfaces and job conditions prepared by other Sections before commencing work of this Section. Commencement indicates acceptance of existing conditions.

3.2 Finishing of Concrete

3.2.1 Finish concrete in accordance with CSA-A23.1 Class A.

3.2.2 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.

3.3 Curing and Sealing

3.3.1 Cure and protect the surface of finished floors in accordance with CSA-A23.1 and/or specified herein.

3.3.2 See Section 03 30 00 for general curing and protection requirements, including cold weather requirements.

3.3.3 Cure finished concrete surfaces which are to remain exposed with an approved curing compound which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Ensure that the curing compound will be compatible with the sealers and thin set tile which are to be applied later. Apply the compound in strict accordance with the manufacturer's instructions.

3.3.4 Protect concrete from premature or excessive drying, temperature extremes, and damage immediately following finish. Maintain minimal moisture loss at relative constant temperature.

3.3.5 Cure for minimum seven (7) days or until 70% of the specified concrete strength has been obtained.

3.3.6 During curing period, protect concrete from damage by equipment, temperature change, stored materials, curing procedures, rain, or running water.

3.3.7 Protect surfaces which will be exposed to direct sunlight during the curing period, immediately after the curing and sealing compound has hardened sufficiently.

3.4 Treatment of Formed Surfaces

3.4.1 The basic treatment to all formed concrete surfaces, exposed or unexposed, is to be to Clause 24 of CSA-A23.1.

3.4.2 Do not repair honeycomb areas until inspected by Consultant. Fill honeycomb in non-structural elements with mortar; repair honeycomb in structural elements in accordance with CSA-A23.1.

3.5 Slab finishes

3.5.1 The tops of all floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated on the drawings, ready to receive the specified finish, in accordance with CSA-A23.1.

3.5.2 Finish concrete floors to a hard steel trowelled finish unless indicated otherwise on the drawings. Place, strike off, consolidate, level and float to the proper elevation. Begin trowelling after surface has received a float finish. The slab drying must proceed naturally and must not be hastened by the dusting on of dry cement or sand. Lightly tool all edges at construction joints and exercise care that slab edges are not depressed along bulkheads during finishing operations, particularly hand trowelling. Provide standard trowel finish at all sub-slabs.

3.6 Protection of Finished Surfaces

3.6.1 Keep traffic, which would affect and/or otherwise disturb the curing procedures, off the finished surfaces for a period of seven (7) days minimum.

3.6.2 Protect exposed concrete finishes against damage until the building is accepted by the Owner.

END OF SECTION

Part 1 GENERAL

1.1 Summary

1.1.1 This section specifies requirements for hydrostatic testing of concrete structures.

1.2 Related Sections

1.2.1 Section 03 30 00 - Cast-in-place Concrete

1.3 Reference Standards

1.3.1 This Section incorporates by reference the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of a listed document, the requirements of this Section prevail.

1.3.2 BCBC 2018 - British Columbia Building Code.

1.3.3 NBC 2015 - National Building Code.

1.3.4 ACI 350.1 - Tightness Testing of Environmental Engineering Concrete Structures

1.3.5 Provincial safety standards where applicable.

1.4 Submittals

1.4.1 Procedures: Section 01 33 00.

Part 2 PRODUCTS

2.1 Contractor-Supplied Products

2.1.1 All equipment and material required for testing, flushing and disinfection shall be part of the Work. This includes water for testing, and flushing.

2.2 Water

2.2.1 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.

2.3 Safety

2.3.1 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 also should be checked prior to application.

Part 3 EXECUTION

3.1 Pre-operational checkout and testing

3.1.1 Delegate Work performed under the requirements this Section into the appropriate Work area(s)

3.1.2 Implement field quality control measures to facilitate compliant construction and demonstrate compliance with the Contract Documents.

3.1.3 Perform the following additional pre-operational check-out and testing activities:

(1) **Hydrostatic Testing.**

(a) Concrete tanks, basins, reservoirs and channels which have walls or slabs subjected to hydrostatic pressure shall be tested for watertightness. The tests shall be made after the structure is complete and the concrete has achieved its specified 28-day strength, but prior to application of waterproofing coating or backfilling. Filling of the tank for the watertightness test shall not exceed a rate of 4 feet (1.22m)/hour. Filling with water at this maximum rate shall continue to the maximum operating water surface. The water shall be kept at this level for at least 72 hours and then the dry sides of all walls and the base perimeter of the slab shall be visually inspected for evidence of leakage. Damp spots, leakage, or seepage revealed by the test, including those caused by shrinkage of concrete, honeycombed areas, construction joints, or other sources shall be repaired by repair methods specified in Section 03 30 00. Damp spots are defined as spots from which water that can be picked up on dry hand.

(b) The Contractor shall re-test tanks or channels which have been repaired to check the suitability of repairs. Water required for testing and re-testing shall be provided by the Contractor and disposed of so as not to create a nuisance.

(c) All liquid retaining or conveying concrete structures must meet maximum leakage criteria set forth in ACI 350.1 as follows:

	Structure Type	ACI 350.1 Designation	Tightness Criterion
(1)	Cylindrical water and wastewater storage tanks and reservoirs other than digesters	HST-025	0.025% per day
(2)	Digesters	SHT-050	0.050% per day (surcharged hydrostatic test)
(3)	Rectangular basins and tanks	HST-050	0.050% per day
(4)	Concrete paved reservoirs and channels	HST-100	0.10% per day

Note: All damp spots on or leakage through walls or wall-to-slab joints shall be repaired as described above. Leakage equal to or less than the values shown in the table above is permitted only through the base slab or mat foundation.

(d) Volume loss shall be measured by measuring the vertical distance from the water surface to a fixed point on the tank above the water surface taking into account evaporation from open surfaces. If the drop in water surface in the 24-hour period exceeds the values given in the table above, exclusive of evaporation, the leakage shall be considered excessive and shall be remedied.

(e) The Contractor shall supply, install and remove a liquid level measuring device with a sharp pointed metal probe with a locking or clamping screw. The device is to have a scale graduated in millimetre.

(f) Submit test results.

END OF SECTION

PART 1 GENERAL

1.1 Scope of Work

1.1.1 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

1.2.1 Perform miscellaneous metal work in accordance with the following standards, except where specified otherwise.

1.2.2 Provide one copy on site of the first two standards listed below.

.1 BCBC 2018, 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

1.3.1 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 with regard to public safety.

1.3.2 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

1.4.1 Conform to good construction practice with regard to safety.

1.4.2 Carry out miscellaneous metal work in accordance with the British Columbia Building Code.

1.5 Qualifications

1.5.1 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.

1.5.2 Welding of steel is to be as per CSA-W59. Welding of aluminum to be as per CSA-W59.2.

1.5.3 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.

1.5.4 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

1.6.1 Design components and connections in accordance with the ABC and CAN/CSA-S16.1 to resist all loads indicated on the drawing or as specified.

1.6.2 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.

1.6.3 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.

1.6.4 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.

1.6.5 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.

1.6.6 Verification of design capacities by calculation to be made available to the Owner's Representative.

1.7 Submittals

1.7.1 Submit in writing evidence of qualification for welding under CWB.

1.7.2 Submit evidence of ability to weld reinforcing steel in accordance with CSA-W186.

1.7.3 Submit design calculations sealed and signed by a professional Structural Engineer registered in the Province of British Columbia.

1.7.4 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.

1.7.5 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

1.8.1 Submit Shop Drawings in accordance with Section 01 33 00.

1.8.2 Clearly indicate materials, components, core thicknesses, finishes, dimensions, connections, joints, method of anchorage, number of anchors, supports, reinforcement, fabrication and installation details and accessories.

1.8.3 Clearly show all shop and erection details including cuts, copes, holes and threaded fasteners.

1.8.4 Clearly show all welds, both shop and field, by the currently recommended symbols of the Canadian Welding Bureau.

1.8.5 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

1.9.1 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 APEGGA Responsibilities for Engineering Services for and Building Projects.

1.10 Inspection and Testing

1.10.1 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 45 00 of these specifications.

1.10.2 The Contractor is responsible to inspect and test materials and workmanship to ensure miscellaneous metals work conforms to the requirements of the Contract Documents.

1.10.3 Provide casual labour and access for inspection to all places where work is being done or stockpiled.

1.10.4 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.

1.10.5 The inspection and testing firm will inspect all bolts for all snug-tightened high-strength bolted connections.

1.10.6 The inspection and testing firm will test all Nelson Studs.

1.10.7 The inspection and testing firm will inspect surface preparation and cleaning for painted and galvanized steel.

1.10.8 The inspection and testing firm will inspect and verify one coat paint, primer, zinc coat and galvanizing thickness.

1.10.9 The Contractor is to inspect and test all miscellaneous metal work to ensure compliance with the Contract Documents.

1.10.10 The Owner's Representative may request additional testing of welds and bolts to ascertain the full amount of defects if the tests noted above indicate excessive deficiencies. Additional costs for extra testing to be borne by the Contractor.

1.10.11 Contractor to pay for all costs for re-testing and re-inspection as a result of defective workmanship.

1.10.12 Contractor to pay for all costs of repairs to correct defective work.

1.10.13 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.

1.10.14 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

1.11.1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.

1.11.2 Additional testing, inspection and evaluation may be required where evidence points to a potentially deficient structure.

1.11.3 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.

1.11.4 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.

1.11.5 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

1.12.1 Use all means necessary to protect fabrications before, during and after installation.

1.12.2 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

1.13.1 Schedule delivery of components to site to coincide with installation of Work.

1.13.2 Store components to prevent damage and distortion.

1.13.3 Protect finishes from scratches and soiling.

1.13.4 Store materials in a safe, dry, above ground location.

1.13.5 Prevent contact with material that may cause corrosion, discolouration or staining.

1.14 Coordination With Other Trades

1.14.1 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.

1.14.2 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

2.1.1 Supply new materials, free from defects impairing strength, durability or appearance, of the best commercial quality for purposes specified.

2.1.2 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.

2.1.3 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.

2.1.4 Structural steel angles with 80 mm legs or less: To CSA-G40.21 of Type W weldable steel. Minimum yield strength 300 MPa.

2.1.5 Shear stud connections: Headed concrete anchors conforming to ASTM A108.

2.1.6 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.

2.1.7 Anchor bolts as noted on the drawings to ASTM A193 and A449.

2.1.8 Welding materials as per CSA-W59.

2.1.9 Stainless steel: To ASTM A167 and ASTM A276, Type 316L as indicated on the drawings.

2.1.10 Structural Aluminum: 6061-T6.

2.1.11 Nut dimensions as per ASA B182 for heavy semi-finished hexagon nuts.

2.1.12 For fastenings in stainless steel use stainless steel Type 316 ELC ASTM A167.

2.1.13 All fasteners submerged in water or sewage: Stainless steel Type 316 ELC ASTM A167.

2.1.14 Drilled adhesive anchors refer to Section 03 15 00.

2.1.15 One-coat paint where no further painting is specified: Conform to CISC/CPMA 1.73a, Structural Steel One-Coat Paint.

2.1.16 Primer where further painting is specified: Conform to CISC/CPMA 2-75, Structural Steel Primer.

2.1.17 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 09900 – Painting.

2.1.18 Shop and field studs to be Nelson headed type anchors with fluxed ends or approved equivalent. Sizes as detailed on drawings.

2.1.19 Shop galvanizing: Hot dipped galvanizing with a minimum coating of 900 g/m^2 to CAN/CSA-G164.

2.2 Corrosion Protection

2.2.1 Conform to Section 09 91 00.

2.2.2 Use stainless steel, aluminum or galvanized steel where indicated on Drawings.

2.3 Safety Chains

2.3.1 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

2.4.1 Fabricate and install steel ledger angles and lintels as detailed on the drawings and reviewed shop drawings, complete with anchors or bolts, as indicated.

2.4.2 Fabricate and install steel ledger angles and lintels to withstand all superimposed loading.

2.4.3 Install level and true to line.

2.5 Steel Framing Around Openings

2.5.1 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.

2.5.2 Coordinate installation of steel framing with doors, windows, louvres and the like, to ensure openings are correctly sized.

2.5.3 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

2.6.1 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.

2.6.2 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.

2.6.3 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.

2.6.4 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.

2.7.1 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

2.8.1 Refer to Drawings for miscellaneous metal items and embedded plates which are to be fabricated, supplied and installed under this Section.

2.8.2 Fabricate all other metal fabrication items or miscellaneous metal items required to complete the project.

2.9 Hatch Covers

2.9.1 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.

2.9.2 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.

2.9.3 Hatches to open 90º and lock automatically in that position.

2.10 Loose Bearing Plates and Leveling Plates

2.10.1 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

2.11.1 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. Ladders include, but are not limited to the following:

.1 Fabricate and install exterior roof ladders as detailed.

2.12 Fabrication

2.12.1 Notify the Owner's Representative and inspection and testing firm a minimum of 24 hours prior to fabrication to allow for inspection.

2.12.2 Fabricate miscellaneous metals in accordance with CAN/CSA-S16.1, the drawings, specifications and the reviewed shop drawings.

2.12.3 Verify dimensions of existing work, site conditions, and drawing dimensions prior to commencing fabrication.

2.12.4 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

2.12.5 No cutting or provision for holes except as on approved drawings.

2.12.6 Bolted connections to be friction type connections.

2.12.7 Shop installed shear studs to be installed in strict conformance with requirements of CSA-W59.

2.12.8 Tolerances of all miscellaneous metal to be maintained strictly in accordance with CAN/CSA-S16.1.

2.12.9 Grind all welds smooth and grind all groove welds flush on exposed structural steel.

2.12.10 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.

2.12.11 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.

2.12.12 Weld all anchors required to restrain concrete masonry walls.

2.12.13 Weld shear stud connectors in strict accordance with manufacturer's instructions by electrical resistance only.

2.12.14 Galvanize all structural steel components noted or specified to CAN/CSA-G164.

2.12.15 Apply one coat of paint or primer where required.

2.12.16 Provide two coats of alkali resistant bituminous paint to all aluminium in contact with or imbedded in concrete mortar or grout.

2.13 Surface Preparation

2.13.1 Thoroughly clean and suitably pretreat steel prior to finishing.

2.13.2 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.

2.13.3 Grind and sand all sharp projections smooth.

2.14 Finishes

2.14.1 Shop paint items, all miscellaneous metal items with the exception of those which are to be galvanized or special coating.

2.14.2 Do prime painting to CSA-S16-01. Ensure shop primers are compatible with paint finishes and special coatings.

2.14.3 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.

2.14.4 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.

2.14.5 Apply two (2) coats of primer to parts inaccessible after assembly.

2.14.6 Apply one (1) coat of primer to steel surfaces except where encased in concrete. Leave these surfaces clean and uncoated.

2.14.7 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.

2.14.8 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.

2.14.9 Back prime with bituminous paint all aluminum surfaces in contact with concrete or masonry.

2.14.10 Provide hot dipped galvanized finish at all exterior metal fabrications and elsewhere indicated.

PART 3 EXECUTION

3.1 Surface Conditions

3.1.1 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.

3.1.2 Verify that metal may be fabricated and erected in strict accordance with the original design, the approved shop drawings and the referenced standards.

3.1.3 In the event of a discrepancy, immediately notify the Owner's Representative.

3.1.4 Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Erection

3.2.1 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 as long as required for safety.

3.2.2 Use bolts for field connections except where welded field connections called for on drawings.

3.2.3 Tolerance of all structural steel to be maintained strictly in accordance with CAN/CSA-S16.1.

3.2.4 Obtain acceptance of Owner's Representative prior to site cutting or making adjustments to other work.

3.3 Certification

3.3.1 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 Related Sections

1.1.1 Section 08 70 00 Hardware

1.1.2 Section 09 91 00 Painting

1.2 References

1.2.1 American Society for Testing and Materials (ASTM):

.1 ASTM A591/A591M 98 Standard Specification for Steel Sheet, Electrolytic Zinc Coated, for Light Coating Weight (Mass) Applications.

.2 ASTM A653/A653M 04a Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy coated (Galvannealed) by the Hot Dip Process, Lock Forming Quality.

.3 ASTM A924/A924M 04 Standard Specification for General Requirements for Sheet Steel, Metallic Coated by the Hot Dip Process.

1.2.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 1.181 99, Ready Mixed Organic Zinc Rich Coating.

.2 CGSB 41 GP 19Ma 84, Rigid Vinyl Extrusions for Windows and Doors.

1.2.3 Canadian Standards Association (CSA):

.1 CAN/CSA G40.20/G40.21 04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.2 CSA W59 03 Welded Steel Construction (Metal Arc Welding).

1.2.4 Underwriters' Laboratories of Canada (ULC):

.1 CAN4 S104 1980 (R1985) Fire Tests of Door Assemblies.

.2 CAN4 S105 1985(R1992) Fire Door Frames Meeting the Performance Required by CAN4 S104.

1.2.5 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA):

.1 CSDFMA Specifications for Commercial Steel Doors and Frames, 1995.

.2 CSDFMA Recommended Selection and Usage Guide for Commercial Steel Doors, 1995.

1.2.6 National Fire Protection Association (NFPA):

.1 NFPA 80 1999 Fire Doors and Windows.

.2 NFPA 252 2003 Standard Methods of Fire Tests of Door Assemblies.

1.2.7 ITS/Warnock Hersey Professional Services Ltd. (WHI):

.1 Fire Rating Services, Building Materials and Equipment, Listings (ITS/WH).

1.3 Submittals

1.3.1 Comply with requirements of Division 1.

1.3.2 Shop Drawings: Clearly indicate general construction of each type of door, configurations, material, material thickness, jointing methods, mortises, reinforcements, anchors, finish and special features.

1.3.3 Reference door types to Door Schedule. Indicate door numbers where applicable.

1.4 Quality Assurance

1.4.1 Manufacture fire door and frame components and assemblies to ULC or ITS Warnock Hersey requirements.

1.4.2 Doors shall bear testing agency label indicating fire endurance rating for standard doors.

1.4.3 Hollow Metal Trades Association Canadian Manufacturing Standards for Metal Doors and Frames.

PART 2 PRODUCTS

2.1 Materials

2.1.1 Steel Sheet:

.1 Insulated: Metallic coated steel sheets in accordance with ASTM A924/M924; coated to meet requirements of ASTM A653/A654M, Commercial Steel (CS), Type B, ZF120 (A40) galvannealed; stretcher levelled standard of flatness where used for face sheets.

.2 Interior Doors and Frames: Electrolytic zinc coated steel sheets in accordance with ASTM A591/A591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher levelled standard of flatness.

2.1.2 Door Cores:

.1 Honeycomb: Structural small cell (25 mm (1”) maximum) kraft paper honeycomb; minimum weight 36.3 kg (80#)/ream; minimum density 16.5 kg/m3 (1.03 ft3); sanded to the required thickness.

.2 Polystyrene: Rigid extruded, closed cell insulation, fire retardant treated meeting the requirements of ULC S701, Type 4, minimum thermal resistance RSI 0.87 (R 5.0)/25 mm (1”) thickness.

2.1.3 Adhesives:

.1 Core Adhesive: Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.

.2 Interlocking Edge Seam Adhesive: Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, and sealant/adhesive.

2.1.4 Primer:

.1 Rust inhibitive primer meeting CAN/CGSB 1.132, shop prime coat doors and frames before delivery; grey or red coloured primer; clear primer not acceptable; provide primer for field touch up.

2.1.5 Floor Anchors, Channel Spreaders, 1.6 mm (0.060”) tee anchors, 1.20 mm (0.048”) Wall Stud Anchors, and as follows:

- Hot-dipped zinc coated for exterior locations.
- Wipe coat galvanized for interior locations.
- Corrugated, galvanized tee anchors for masonry bond.
- Drill stud anchors for wire tie to studs.
- Lag bolts, shields and bushing for existing or concrete openings.
- Provide anchors appropriate to installation conditions.

2.1.6 Sealant: As specified in Section 07 90 00 Sealants.

2.1.7 Exterior Top Caps: Rigid polyvinylchloride (PVC) extrusion in accordance with CAN/CGSB 41 GP 19Ma.

2.1.8 Door Silencers (Bumpers): Black neoprene; three silencers on strike jambs of single door frames; two silencers on heads of double door frames; stick on bumpers are not acceptable.

2.2 Door Fabrication

2.2.1 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; 45 mm (1 ¾”) thickness of types and sizes indicated in Section 08700 – Door, Frame and Hardware Schedule, and as follows:

.1 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.

.2 Form edges true and straight with minimum radius suitable for thickness of steel used.

.3 Bevel lock and hinge edges 3 mm (1/8”) in 50 mm (2”); confirm requirement with builder’s hardware or door swing that could dictate a different bevel.

.4 Top and bottom of doors shall be provided with inverted, recessed, 1.6 mm (0.060”) steel end channels, welded to each face sheet at 150 mm (6”) O/C.

.5 Provide fire labelled doors for those openings requiring fire protection ratings, as indicated on Drawing 73150A-601 – Architectural Lift Station Schedules.

.6 Fabricate doors with the following clearances:

- Clearance between door and frame and between meeting edges of doors swinging in pairs shall not exceed 3 mm (1/8”).
- Clearance between the bottom of door and floor shall not exceed 19 mm (¾”) where there is no sill.

- Clearance between bottom of door and a raised non combustible sill shall not exceed 10 mm (3/8”).
- Clearance between bottom of door and nominal surface of combustible floor coverings shall not exceed 12 mm (½”).

2.2.2 Insulated Doors: Flush, lock seam construction, insulated doors fabricated in accordance with CAN/CGSB 82.5, and as follows:

.1 Face sheets: Minimum 1.6 mm (0.060”) base steel sheet thickness.

.2 Stiffened, insulated and sound deadened with polystyrene core laminated under pressure to each face sheet.

.3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam.

2.2.3 Interior Doors: Flush, lock seam construction, hollow metal doors fabricated in accordance with CSDFMA Manufacturing Specifications for Doors and Frames, and as follows:

.1 Face sheets: Minimum 1.6 mm (0.060”) base steel sheet thickness.

.2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.

.3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam.

2.2.4 Fire Rated Doors: Flush, lock seam construction, hollow metal doors fabricated in accordance with CAN4 S104 and NFPA 80, and as follows:

.1 Face sheets: Minimum 1.6 mm (0.060”) base steel sheet thickness.

.2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.

.3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam.

.4 Equip pairs of fire labelled doors with minimum 2.7 mm (0.105”) steel surface mounted flat bar astragal, shipped loose for application on site.

.5 Labelled by Underwriters Laboratories of Canada, ITS/Warnock Hersey, or other testing laboratory approved by the authority having jurisdiction.

2.3 Frame Fabrication

2.3.1 Fabricate door frames with mitred corners of frames and weld continuously along inside of frame profile, or lap and weld concealed corner plates, making exposed faces flush, mitres tight, filled, and finished smooth, and as follows:

.1 Knock down (“KD”) frames are not acceptable and will be rejected.

.2 Jambs, heads, mullions, sills and centre rails shall be straight and uniform throughout their lengths.

.3 Factory assembled frame product shall be square, free of defects, warps or buckles.

.4 Accurately cope joints at mullions, transom bars, sills or centre rails, butted and tightly fitted, with faces securely welded, matching corner joint faces.

.5 Fabricate frames in sections for field splicing where required due to site access, or when shipping limitations dictate smaller assemblies, and as follows:

- Provide 1.60 mm (0.060”) splice plates for field spliced jambs, heads and sills, securely welded into one section, extending 100 mm (4”) minimum each side of splice joint.
- Provide 1.60 mm (0.060”) splice plates for field splices at closed sections (mullions or centre rails) securely welded to the abutting member; extend 100 mm (4”) minimum into closed sections when assembled.
- Field splice joints shall be welded, filled and ground to present a smooth uniform surface after assembly is complete.

.6 Provide two (2) temporary steel jamb spreaders welded to the base of the jambs or mullions to maintain proper alignment during shipping and handling; remove spreaders before anchoring frame to floor.

.7 Prepare door opening for single stud door silencers, three (3) for single door openings, two (2) for double door openings; shipped loose for installation after finish painting.

.8 Provide fire labelled frames for those openings requiring fire protection ratings, as indicated in Section 08 80 00 Door, Frame and Hardware Schedule.

2.3.2 Frames:

.1 Interior Frames: 1.60 mm (0.060”) minimum for single doors; 1.90 mm (0.075”) for frames with opening width in excess of 1220 mm (48”), with 50 mm (2”) face standard frame profile, throat and frame width to suit wall construction

.2 Include standard pressed steel glazing stops, minimum height 16 mm (5/8”) full length for opening, butt edge corners, counter sunk oval head screw fastening; stops installed on interior side of screens.

2.4 Hardware Preparation

2.4.1 Prepare doors in coordination with hardware schedule in Section 08700 and templates provided by the hardware supplier, and as follows:

.1 Fully Templated Mortised Hardware: Factory blank, reinforce, drill and tap doors.

.2 Non Fully Templated Mortised Hardware: Factory blank and reinforce only.

.3 Surface Mounted Hardware: Factory reinforce only.

.4 Templated Holes 13 mm (½”) and Larger: Factory prepared, except mounting and through bolt holes shall be site prepared at the time of application.

.5 Templated Holes Less Than 13 mm (½”) Ø: Factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when holes overlap function holes.

.6 Site drill and tap for surface mounted hardware or mortised hardware that is not fully templated at the time of hardware application.

2.4.2 Hardware Reinforcement for Doors and Frames: carbon steel, welded in place, prime painted, to the following minimum thicknesses:

.1	Hinge, pivot and panic bar reinforcements	3.5 mm (0.138”)
.2	Lock face, flush bolts, concealed bolts	1.6 mm (0.060”)
.3	Strike reinforcements	1.6 mm (0.060”)
.4	Concealed or surface closer reinforcements	2.7 mm (0.105”)
.5	Electronic hardware reinforcements	1.6 mm (0.060”)
.6	Door jamb reinforcement, structural steel shape	100 mm (4”) x 38 mm (1½”)
.7	Door surface hardware reinforcements	1.6 mm (0.060”)
.8	Frame surface hardware reinforcements	2.7 mm (0.105”)
.9	Guard boxes to protect mortised cut outs from mortar or spray applied insulation, fully welded	0.80 mm (0.031”)

2.4.3 Electronic Door Hardware Preparation:

.1 Provide templated hardware enclosures and junction boxes; inter connected with CSA approved 13 mm (½”) Ø conduit and connectors.

2.5 Finishing

2.5.1 Shop apply zinc-rich primer, repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site.

2.5.2 Remove weld slag and splatter from exposed surfaces.

2.5.3 Fill and sand smooth all tool marks, abrasions and surface blemishes to present smooth uniform surfaces.

2.5.4 Field apply, factory supplied touch up primer on exposed surfaces where zinc coating has been damaged during installation.

PART 3 EXECUTION

3.1 Frame Installation

3.1.1 Install steel doors, frames, and accessories in accordance with Shop Drawings, CSDFMA Installation Guide, manufacturer's data, and as specified.

3.1.2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm (1/12”) out of plumb measured on face of frame, maximum twist corner to corner of 3 mm (1/8”); align horizontal lines in final assembly.

3.1.3 Remove temporary braces and spreaders after completion of adjacent work, leaving surfaces smooth and undamaged after wall construction is completed.

3.1.4 Place frames before construction of enclosing walls and ceilings, and as follows:

.1 Masonry construction: Provide a minimum of three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.

.2 Metal Stud Partitions: Provide a minimum of three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb; attach wall anchors to studs with screws.

.3 Install an additional anchor at hinge and strike jambs for openings 2286 mm (90”) or more in height.

3.1.5 Install glazing materials and studded door silencers. Fully seal all glazing joints in hygienic areas.

3.1.6 Field assemble large screens to provide true and even alignment with flush butt hairline jointing, all fasteners concealed.

3.1.7 Do not site weld unless approved by Consultant in writing for the specific screen.

3.1.8 Provide formed steel drip section full width of frame opening for exterior doors.

3.1.9 Install fire rated frames in accordance with NFPA 80.

3.2 Door Installation

3.2.1 Fit steel doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.

3.2.2 Install hardware in accordance with manufacturers' templates and instructions.

3.2.3 Adjust operable parts for correct clearances and function.

3.2.4 Install fire rated doors within clearances specified in NFPA 80.

3.3 Adjusting and Clean Up

3.3.1 Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of air drying primer compatible with factory applied primer, and as follows:

.1 Clean exposed surfaces with soap and water to remove foreign matter before site touch up.

.2 Finish exposed field welds to present a smooth uniform surface and touch up with rust inhibitive primer.

.3 Touch up exposed surfaces that have been scratched or otherwise marred during shipment, installation or handling with rust inhibitive primer.

3.3.2 Keep steel surfaces free of grout, tar or other bonding materials or sealers; clean grout or other bonding material from surfaces immediately following installation.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

1.1.1 Section 08 11 00 Hollow Metal Doors and Frames

1.2 Submittals

1.2.1 Comply with requirements of Section Division 1.

1.2.2 Hardware Schedule: Submit a detailed hardware schedule indicating the following:

.1 Door and frame types, sizes and door swings.

.2 Type, style, function size and finish of each hardware item.

.3 Mounting heights, fastenings and other pertinent information.

.4 Name and manufacturer of each item.

.5 Location of all hardware items cross-referenced to door numbers indicated on floor plans and in door and frame schedule.

.6 Explanation of all abbreviations, symbols and codes contained in schedule.

1.2.3 Keying Schedule: Submit a separate keying schedule indicating method of keying, numbers and quantities of keys supplied along with hardware and other requirements. Indicate also any special keying requirements requested by Owner.

1.2.4 Product Data: Submit manufacturer's product data for each item of hardware.

1.3 Templates

1.3.1 Furnish door and frame manufacturers with complete instructions and templates Confirm that all backing and structural support required for hardware has been provided by door and frame manufacturers during fabrication.

1.4 Maintenance Data

1.4.1 Provide the following:

.1 Manufacturer's maintenance instructions.

.2 Complete parts list.

.3 Manufacturer's installation instructions for all hardware.

1.5 SUPPLIER QUALIFICATIONS

1.5.1 Suppliers shall be registered in the Province of Alberta, be well established in this field and have adequate equipment, maintenance and advisory capacities to suit job requirements.

1.6 PRODUCT DELIVERY & STORAGE

1.6.1 Deliver all hardware in original boxes and packaging bearing manufacturers seals and labels.

1.6.2 Include all mounting screws and fastenings with packaging.

1.6.3 Store hardware on site in a secure, dry enclosure.

1.7 Protection

1.7.1 Protect knobs, handles, push plates, pulls, kickplates and other finish hardware exposed after installation, with adhesive release paper, of type which is easily removed without marring finish.

1.8 Extended Warranties

1.8.1 Provide copies of individual manufacturer's warranties that extend beyond the Contractor's normal one year warranty.

PART 2 PRODUCTS

2.1 Exterior Doors

2.1.1 Provide the following products or approved equivalents:

2.1.2 Hinges: McKinney or equivalent. 3 knuckle with 2 concealed bearings. Hinges to be stainless steel material with NRP on all out-swinging exterior doors. Ensure hinges are of adequate width to clear trim.

2.1.3 Closers: Sargent 351 series. All closers to meet ANSI standards A156.4 Grade 1. Use one manufacturer for all closer units throughout the work. Closers shall be non-sized, fully adjustable and complete with full cover. Pack closers with parallel arm shoe where required. Supply appropriate closer arms and mounting brackets door and frame conditions.

2.1.4 Thresholds, seals, and door bottoms: Pemko. Exterior thresholds shall be set in solid mastic and secured with countersunk stainless steel screws and lead shields every 300 mm.

.1 Weather Stripping:

- Head and jamb seal: Stainless steel retainer strip with rubber insert, satin finish.
- Door bottom sweep: Stainless steel retainer strip with rubber insert, satin finish.

.2 Astragal: Full height, NGP 139SS
Kickplate: 630 Trimco K0050
Flush bolts (double door inactive leaf): Trimco 3917
Door locks: Sargent DG3-AV-8251, LNJ, 32D

2.2 Fasteners

2.2.1 Supply all necessary screws, bolts and other fasteners of suitable size and type to adequately and permanently secure hardware in place.

2.2.2 Fasteners shall be of same material and finish as hardware.

2.2.3 Use fasteners that are compatible with materials through which they pass.

2.3 Hardware Finishes

2.3.1 Conform to finishing requirements contained in applicable ANSI/BHMA Standard for hardware.

2.4 Keying

2.4.1 Nomenclature shall conform to the American Society of Architectural Hardware Consultants handbook entitled "Keying".

2.4.2 Form keys from nickel silver.

2.4.3 Furnish two change keys for each lock except where noted otherwise.

2.4.4 Keying System:

.1 Establish a Great Grand Master keying system utilizing a 6-increment pin tumbler system.

.2 Key doors to same rooms or areas alike.

PART 3 EXECUTION

3.1 Inspection

3.1.1 Inspect doors and frames prepared by others and ensure they are adequate to receive required hardware.

3.2 Installation - General

3.2.1 Ensure that all backing and structural support required for hardware has been provided by door and frame suppliers during fabrication.

3.2.2 Install all hardware items to manufacturer's instructions and recommendations.

3.2.3 Where hardware items are required to be installed onto or into surfaces that are to be later painted or finished, install hardware completely to ensure proper fit, remove and store until finishing is complete, and then reinstall.

3.2.4 Drill and countersink units that are pre-prepared for anchorage of fasteners. Space fasteners and anchors to manufacturer's recommendations.

3.2.5 Install hardware to heights and centres as indicated in reviewed hardware schedule.

3.2.6 Set all components level, plumb and true to line and location.

3.2.7 Protect doors and frames form damage due to installation of hardware.

3.3 Installation of Hinges

3.3.1 Install three hinges per door for doors up to 2280 mm high and one additional hinge for every additional 760 mm.

3.3.2 Install each hinge flush with surface of door and frame so as to prevent binding.

3.3.3 Attach hinges to metal work using paint clearing template machine screws.

3.4 Installation of Lock/Latch Sets

3.4.1 Provide and install manufacturers standard wrought box strike for each lock or latch bolt, with curved lip extended to protect frame. Finish to match hardware set.

3.4.2 Secure lock and latch sets to metal doors using machine screws.

3.5 Installation of Closers

3.5.1 Unless otherwise indicated, install closers on room side of door.

3.5.2 Secure to metal doors using template machine screws and sex bolts.

3.5.3 Install all necessary mounting plates, extra length arms and other special accessories.

3.6 Adjustment

3.6.1 During installation and upon completion, adjust hardware to ensure correct and smooth operation.

3.6.2 Adjust closer speeds to provide positive and quiet latching and back checking. Set closers to provide maximum degree of opening without interference.

3.6.3 Ensure key cylinders are installed in correct locations and that keys work properly.

3.7 Clean Up

3.7.1 Remove all protective coatings when instructed to do so by the Owner's Representative.

3.7.2 Clean and polish all hardware.

3.7.3 Remove and replace any scratched, marred or damaged hardware.

3.8 Hardware Schedule

3.8.1 Refer to Drawings for hardware groups.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

.1 Provide, apply and maintain the specified field applied protective and maintenance coating systems. Coatings are required on all process and mechanical equipment, electrical equipment, vessels and pipes unless specifically accepted.

.2 Refer to Drawings and Schedules for the type, location, and extent of coatings required and included for all field coating necessary to complete all the work shown, specified or scheduled.

1.2 REFERENCE STANDARDS

.1 Conform to the following reference standards:

.1 AWWA C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

.2 AWWA C218, AWWA Standard for Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.

.3 CAN/CGSB 1.61, Exterior and Interior Marine Alkyd Enamel.

.4 CAN/CGSB 1.69, Aluminum Paint.

.5 CAN/CGSB 1.143, Silicone Alkyd Heat-Resistant Aluminum Enamel.

.6 CAN/CGSB 1.146, Cold Curing, Gloss Epoxy Coating.

.7 CAN/CGSB 1.153, High-Build, Gloss Epoxy Coating.

.8 CAN/CGSB 1.184, Coal Tar-Epoxy Coating.

.9 CAN/CGSB 85 Series, Painting.

.10 NACE International (NACE) RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Surfaces.

.11 NSF International (NSF) 61, Drinking Water System Components – Health Effects.

.12 SSPC Manual: Steel Structures Painting Council, Surface Preparation Specifications:

- PA 3, Guide to Safety in Paint Applications
- SP 1, Solvent Cleaning
- SP 2, Hand Tool Cleaning

- SP 3, Power Tool Cleaning
- SP 5, Joint Surface Preparation Standard White Metal Blast Cleaning
- SP 6, Joint Surface Preparation Standard Commercial Blast Cleaning
- SP 7, Joint Surface Preparation Standard Brush Off Blast Cleaning
- SP 10, Joint Surface Preparation Standard Near-White Blast Cleaning
- SP 11, Power Tool Cleaning to Bare Metal
- SP 12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating

1.3 SUBMITTALS FOR INFORMATION ONLY

.1 List of Materials: Prior to commencement of work, submit three copies of list with name of manufacturer, number, grade, and quality of materials to be used in the work.

.2 Product and safety data sheets: Submit three copies of data sheets for each product:

1.4 QUALITY ASSURANCE

.1 Prior to commencement of coating operations, meet at site with material supplier's representative and the Owner's Representative to review specifications, coating work to be done, and the following related items:

.1 Equipment use and servicing

.2 Material storage and application techniques

.3 Surface preparation and ambient temperatures

.4 Inspection requirements

.5 Inspection reports

.6 Hold points or check points

.7 Safety requirements during application

.8 Mock-ups or samples of coatings in highly corrosive environments

.2 Arrange with the coating manufacturer to visit the site at a minimum of five intervals during the surface preparation and coating operations to: ensure that:

.1 The proper surface preparation has been completed.

.2 The specified coating products are being used.

.3 The proper number of coats are being applied.

.4 The agreed finishing procedures are being used.

.3 Have the coating manufacturer's representative prepare and submit a written report within three days after completing each visit. Copy the Owner's Representative with the report.

1.5 DELIVERY AND STORAGE

.1 Deliver all coating materials to the site in sealed containers properly labelled to indicate the manufacturer's name, type and colour of contents, date of manufacture, batch number, and storage requirements.

.2 Provide adequately heated and ventilated storage for all materials and ensure compliance with fire prevention regulations.

PART 2 PRODUCTS

1.6 MANUFACTURERS

.1 All constituents of each coating system are to be provided by the same manufacturer.

.2 Acceptable Manufacturers: PPG Canada, Valspar, Sherwin Williams, Benjamin Moore, ICI Paints (Canada)

1.7 SCHEDULE OF SURFACE TREATMENTS

.1 The Schedule of Surface Treatments defines the components of the protective coating system.

Schedule of Surface Treatments		
Ref.	**Description**	**Surface Treatments**
A	Solvent Cleaning	As per SSPC-SP1
B	Hand Tool Cleaning	As per SSPC-SP2
C	Power Tool Cleaning	As per SSPC-SP3
D	Brush Blast	As per SSPC-SP7
E	Near White Metal Blast	As per SSPC-SP10
F	White Metal Blast	As per SSPC-SP5 (NACE #1)
G1	Abrasion	Lightly abrade surface using steel wool or abrasive cloth to provide a key for the next coat, to remove runs or excessive brush marks.
G2	Power Wash	As per SSPC SP12
H1	Polyamide epoxy primer	Nominal DFT 100 microns
H2	Wash Primer	Nominal DFT 25 microns
I	Zinc Chromate Primer	Nominal DFT 40 microns
J	Inorganic Zinc Primer	Zinc in ethyl silicate vehicle. Minimum DFT 40 microns
K	Industrial Enamel (to 100ºC)	To CGSB 1.61 Alkyd Enamel. Minimum DFT 30 microns
L	Hi-Solids Epoxy for immersed service	Polyamide epoxy, minimum 80 percent solids, minimum DFT 200 microns
M	Bituminous Paint	To AWWA C218
N	Silicone Alkyd (100ºC to 150ºC)	Min. 60% solids by weight. Nominal DFT 40 microns
O	Silicone Enamel (150ºC to 400ºC)	To CGSB 1.143, DFT 40 microns
P	Fast Drying Aluminum Sealer	To CGSB 1.69, Nominal DFT 25 microns
Q	Canvas Insulation Sealer	Acrylic or PVA latex
R	Hi-solids Epoxy base coat	Polyamide epoxy, minimum 75 percent solids by weight, nominal DFT 100 microns
S	Hi-solids polyurethane topcoat	To SSPC Paint 36, Level 3, minimum DFT 75 microns

1.8 SCHEDULE OF PROTECTIVE SYSTEMS

.1 The schedule of protective systems defines the combination of surface treatments required in each system and the sections of the plant to which it is to be applied. The systems have been grouped into three categories as follows:

.1 *Category A*: Immersed Service, equipment or material fully, partially or intermittently immersed in water during routine plant operation:

- Liquid Tankage, immersed and up to 1.0 metres above water level

.2 *Category B*: Exposed Service, equipment or material exposed to the normal range of atmospheric conditions and conditions common to water treatment facilities (high humidity, etc.) or located in process buildings where humidity and/or exposure to corrosive vapours is present. Includes the following:

- Above grade, external areas
- Liquid Tankage, greater than 1.0 metres above water level
- Pumphouses

.3 *Category C*: Indoor Service, equipment or materials inside buildings or other well ventilated spaces:

- Process tunnels that are general purpose classification
- Building mechanical and electrical rooms
- Other process areas

1.9 CATEGORY A

.1 All Category A systems will be tested by the Owner's Representative using a wet sponge holiday detector set at 67.5 volts. Touch up will be required at points where the detector is grounded.

.2 Schedule:

Schedule of Systems

System	Surface Treatments	Typical Applications
A1	A, G2, L, L	Ferrous equipment or piping, not including stainless steel, delivered with inorganic zinc primer
A2	A, F, J, L, L	Ferrous equipment or piping, not including stainless steel, delivered uncoated or with coatings not compatible with epoxy, e.g. ductile iron, cast iron or steel pipe and pipe sleeves inside treatment units. External Surfaces at valves, fabricated pipe supports, brackets, etc.
A3	A, G1, M	Aluminum surfaces in contact with concrete, e.g. access cover frames
A4	A, E	Ferrous metal surface cast into concrete, e.g. penstocks, pipe sleeves

A5	A	Stainless steels, plastics, and fibreglass products with no finish coat required

1.10 CATEGORY B

.1 Schedule:

Schedule of Systems

System	Surface Treatments	Typical Applications
B1	A, B, R, S	Ferrous equipment or piping, not including stainless steel, delivered with inorganic zinc primer, e.g. motors, flocculator gearbox & motor, valve headstocks, piping above ground & outside treatment units, hydrants, etc.
B2	A, E, J, R, S	Ferrous equipment or piping, not including stainless steel, delivered but not applied with an inorganic zinc prime coat or with a prime coat not compatible with an inorganic zinc overcoat.
B3	A, B, H1, R, S	Galvanized or cadmium plated goods, e.g. pipe supports or brackets, mountings for electrical or control equipment (Unistrut, etc.)
B4	A	Stainless steel or aluminum products, with no finish coat required, e.g. insulation recovering

1.11 CATEGORY B

.1 Schedule:

Schedule of Systems

System	Surface Treatments	Typical Applications
C1	A, B, K, K	Ferrous equipment or piping, not including stainless steel, delivered complete with factory finished coatings. Coated for system identification and maintenance. Surface temperature during operation not exceeding 100ºC, e.g. pumps, air handling units, valves, etc.
C2	A, G, K, K	Ferrous equipment, accessories, or piping, not including stainless steel, fully primed. Surface temperatures not exceeding 100ºC, e.g. pumps, steel piping
C3	A, E, I, N, N	Ferrous equipment, accessories, or piping, not including stainless steel, as C1 or C2 but with operating surface temperatures between 100ºC and 150ºC, e.g. air compressors, blowers
C4	E, J, O	Ferrous equipment, accessories, or piping, not including stainless steel, as C1 or C2 but with operating surface temperatures between 150ºC and 400ºC, e.g. boiler fittings
C5	B, P, K, K	Piping or valves with bituminous or tar coatings. Surface temperatures not exceeding 100ºC, e.g. cast iron & ductile iron pipe, valves.
C6	A, K, K	PVC pipe, fittings or accessories coated for identification only.
C7	A, H2, K, K	Aluminum insulation recovering coated for identification only.
C8	A, Q, G, N, N	Canvas insulation recovering.

NOTE: (1) Surface preparation G-abrasion has not been fully scheduled but is to be carried out between all coatings.

(2) No bare ferrous metal surfaces are permitted. Pipe hanger rods etc., unless zinc or cadmium plated, are to be at least prime coated. Cut ends of plated surfaces (Uni-strut, etc.) are to be spot primed.

1.12 COLOUR CODING

.1 Refer to the Owner's front-end documents for pipe and equipment identification colour coding

PART 3 EXECUTION

1.13 QUALITY ASSURANCE

.1 Apply all paints and coatings strictly in accordance with the manufacturer's directions.

.2 Pay particular attention to ensure the compatibility of each surface treatment with the preceding and subsequent surface treatments and coatings. Ensure the compatibility of all surface treatments and coatings.

.3 Coatings exhibiting visible defects such as drips and runs will not be accepted.

1.14 CONDITION OF SURFACES

.1 Examine surfaces that are to be finished, including existing surfaces that require refinishing.

.2 Report, in writing, to the Owner's Representative surfaces that are defective or which cannot be prepared by usual sanding, cleaning, blasting, or any combination of the three. Report unsatisfactory site and environmental conditions.

.3 Do not commence work on any section until all such defects in that section have been corrected.

.4 On all factory primed or coated equipment, touch up defects prior to the application of subsequent coatings.

.5 Be responsible for the condition of surfaces and for correcting defects and deficiencies in the surface.

.6 Confirm equipment, piping, and ducting systems have successfully passed tests specified prior to painting.

1.15 ENVIRONMENTAL CONDITIONS

.1 Do not apply a coating when the ambient or surface temperature is below 10°C or less than 3°C above the dew point.

.2 Provide adequate ventilation and sufficient heating to maintain temperatures above 7°C for 24 hours before coatings are applied. Continue heating to maintain 10°C during application and for 48 hours after application.

.3 Provide a minimum of 300 lux illumination on surface to be treated.

.4 Do not apply coatings where dust is being generated.

1.16 PROTECTION

.1 Provide sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted. Make good any damage resulting from inadequate or unsuitable protection.

.2 Maintain all coated surfaces until completion of the works. Damage to coatings, occurring at any time, shall be made good within seven days.

1.17 WASTE HANDLING

.1 Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove from the site at suitable intervals.

.2 Refer to the requirements of Division 1.

1.18 PREPARATION

.1 Commencement of work means acceptance of site and substrate conditions.

.2 Remove and, after painting, replace or adequately mask all grease nipples, bright metal surfaces, identification plates and other items not to be painted. Do not use solvent that may remove permanent lacquer finishes.

.3 Exercise special precautions for safety of workmen applying coating in enclosed areas by meeting requirements of Occupational Health and Safety Act, Code, and Regulations.

.4 Comply with instructions on coating manufacturer’s Safety Data Sheets.

.5 Provide surface preparation in accordance with requirements of coating systems and relevant SSPC specifications.

.6 Test surfaces for moisture content. Do not apply materials to substrate when moisture content exceeds 12 percent.

.7 Apply primer within four hours after surface preparation. Comply with SSPC PA-1 for application techniques, requirements and precautions.

.8 Comply with CGSB 85 Series.

1.19 APPLICATION

.1 Apply coatings, free from defects and holidays.

.2 Prevent overspray onto adjacent surfaces.

.3 Do not apply coatings over sealant.

.4 Verify that fabric jacketted pipes and ducts have been sized prior to painting.

.5 Apply finish coats of coatings in thickness per coat specified.

.6 If minimum dry film thickness (DFT) is not achieved, apply additional coats until required thickness is obtained.

.7 Sand semi-gloss, medium, and high gloss finishes lightly between coats, unless otherwise required by the coating manufacturer.

.8 Finish work uniformly as to sheen, gloss, colour, and texture; free from sags, runs and other defects.

.9 Apply materials in accordance with coating manufacturer's instructions. Do not use adulterants.

1.20 TESTING

.1 Test all surfaces receiving coating using a holiday detector, at random locations, but no less than every 2.5 m2. Mark all test spots and record location and result. Provide a copy of results to the Owner's Representative.

.2 Assist the Owner's Representative in random testing to confirm coating thicknesses as reported. These random tests will be taken at locations which may or may not be the same as the original test locations.

.3 Where the measured thickness is insufficient, as found during the original test or in the Owner's Representative's verification, apply additional coats until coating thickness equals or exceeds the minimum thickness specified.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

.1 Include labour, materials, tools, scaffolds and other equipment, services and supervision required to cover the surfaces of the building or structure, the building services and accessories not otherwise protected or covered with paint, as shown and specified in the Contract Documents.

.2 Refer to drawings and schedules for type, location and extent of finishes required, and include the field painting necessary to complete work shown, scheduled and specified, including backpriming.

.3 This section does not include surface preparation and priming to be carried out as specified in Division 5.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Preparation of surfaces to receive finish under this section of work, except as specifically called for in Contract Documents.

.2 Shop painting of structural and miscellaneous metal

.3 Shop coating of metal doors, frames and steel fittings

.4 Shop coating of piping and mechanical equipment.

.5 Miscellaneous equipment not requiring coating. The following equipment will be supplied with factory coatings:

- Pumps,
- electrical panels;
- electric motors;

This equipment is to be cleaned and the factory coatings touched up where they have sustained damage.

.6 Painting is not required on the following:

- Stainless steel - (surface treatment only)
- Brass
- Interiors of pipes and ductwork (unless specified in Division 40)
- Submerged galvanized metal
- Prefinished components specified in other sections
- Equipment name plates

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 Tests by Agencies: shall fully cooperate with the Paint Inspection Agency in the performance of its duties for the duration of the contract.

.2 Design Conditions: Ensure the Paint Inspection Agency inspects surfaces requiring painting. Notify the Engineer and Contractor in writing of any defects or problems, prior to starting work, and after the prime coat is applied and defects become visible in the substrate.

1.4 QUALITY ASSURANCE

.1 Qualification of Manufacturer: the paint products of the Paint manufacturer shall be as listed in the Canadian Painting Contractor Architectural (CPCA) Painting Specification Manual, latest edition, under “Paint Product Recommendation” section.

.2 Qualifications of Applicators: the painting contractor must have a minimum of ten (10) years proven satisfactory experience in related work. Maintain a qualified crew of painters throughout the duration of the work to fully satisfy the requirements of this specification. Engage only qualified journeymen who have a provincial Tradesman Qualification certificate of proficiency and registered apprentices, in painting and decorating work.

.3 Qualification of Testing Agency: perform painting and decorating inspection using an inspector acceptable to the Engineer and in accordance with Chapter 7 of the Architectural Spec. Manual of the CPCA/HPDA of B.C.

1.5 SUBMITTALS

.1 Approvals: submit a written request to the Engineer for his approval of equivalent or alternative products. List each of the materials proposed, surfaces to be covered, manufacturer’s name and brand name of material.

.2 Colours: paint colours as selected by Engineer. Before starting work, obtain from the Engineer a schedule showing where the various colours and finishes are to be applied.

.3 General Colour Requirements: refer to the Contract Documents for type and extent of finishes and as specified under this Section. Paint exterior and interior steel and wood sash, frames, trim and door frames and trim generally same colours but a different colour than adjacent walls. Piping shall be colour coded in accordance with the type of service.

.4 Inspection and Guaranty: furnish a Canadian Painting Contractors (Provincial Association) Two-Year Guaranty, or the alternative 100% Two-Year Maintenance Bond, on completion of this Section's work. The Guaranty or alternative Maintenance Bond shall warrant the work and ensure that it has been performed in accordance with the standards and requirements incorporated in the Canadian Painting Contractors Architectural (CPCA) Specification Manual, (latest edition). The work performed by the Painting and Decorating Subcontractor shall be inspected by an independent inspector acceptable to the Engineer and to the appropriate Provincial Painting and Decorating Contractors Association. The cost of this inspection and the Guaranty or alternative Maintenance Bond shall be included in the tender price.

Painting and Decorating Subcontractors using the Maintenance Bond alternative must supply with their tenders, a facsimile of the bond, together with written proof of their ability to furnish same, at no additional cost to the Corporation. The proposed bond form must include wording which reflects that the Guaranty refers to work undertaken in Canada.

1.6 MOCK UP

.1 Sample Panels: before proceeding with painting work, and when requested by the Engineer, furnish one complete sample area or item of each colour scheme required, show selected colours, finish texture, materials and workmanship. Once approved, the samples shall serve as the standard for like work throughout the project.

1.7 PRODUCT STORAGE AND HANDLING

.1 Delivery of Materials: deliver paint materials to the site in sealed, original labeled containers; bearing manufacturer's name, type of paint, brand name, colour designation and instructions for mixing and/or reducing.

.2 Storage of Materials: Store paint materials at a minimum ambient temperature of 7°C in a well ventilated and heated single designated area, provided by others.

.3 Fire Hazard and Safety: take necessary precautionary measures to prevent fire hazards and spontaneous combustion.

.4 Toxic Materials: where toxic and explosive solvents and materials are used, take appropriate precautions and do not smoke in the area.

1.8 ENVIRONMENTAL CONDITIONS

.1 Temperature, Humidity, and Moisture Control conform to the following:

- Temperatures - do not perform painting when temperatures on the surfaces, or the air in the vicinity of the painting work are below 5°C. the minimum temperatures allowed for Latex paints shall be 7°C (interior work) and 10°C (exterior work) UNLESS specifically approved by the Engineer.

- Relative humidity - do no painting when it is higher than 85%.
- Moisture of surfaces - use electronic “Moisture Meter” testing method.
- Concrete block - maximum moisture content allowed is 12% for solvent type paint.
- Wood - maximum moisture content allowed is 15%.
- Masonry surfaces must be tested for alkalinity.

.2 Note: Concrete shall have cured, and concrete blocks shall be installed at least 28 days prior to painting and ensure surfaces are visually dry on both sides before painting work starts. This is not be to construed as including a “wetting down” process for Latex.

.3 Lighting: do not proceed with painting and decorating work unless a minimum of 15 candle power/sq.ft. lighting is provided on the surfaces to be painted, as per Chapter 10, CPCA/MPDA Manual (latest edition).

.4 Ventilation: areas where painting and decorating work is proceeding require adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 7°C for 24 hours before and after paint application. Provide heating and ventilation as required for the faithful performance of this Section’s work, as per Chapter 10, CPCA/MPDA Manual (latest edition).

1.9 NAME PLATES

.1 All equipment name plates shall be left clean and free of paint.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Provide paint, varnish, stain, enamel, lacquer, and fillers of a type and brand herein specified and listed under “Paint Product Recommendations” described in the Association Manual, latest edition, for specific purposes intended.

.2 Provide paint materials such as linseed oil, shellac, turpentine, etc., and any of the above materials not specifically mentioned herein but required for first class work with the finish specified, of the highest quality product of an approved manufacturer. Ensure coating materials are compatible.

2.2 MIXING

.1 Use ready-mixed paints unless otherwise specified, except field mix any coating in paste or powder form, or to field-catalysed in accordance with the directions of its approved manufacturer. Fully grind pigments and maintain a soft paste consistency in the vehicle during storage which can be dispersed readily and uniformly by paddle to become a complete homogeneous mixture.

.2 Ensure paint has good flowing and brushing properties and is able to dry or cure free of sags, etc. to yield the finish specified.

PART 3 EXECUTION

3.1 INSPECTION OF SURFACES

.1 Surface Examinations: prior to commencement of work of this section, thoroughly examine surfaces scheduled to be painted. Report in writing to the Engineer any condition adversely affecting this work. Do not proceed with painting work until defects have been corrected and surfaces are acceptable to the Painting Inspector.

.2 Surface Acceptance: commencement of work shall not be held to imply acceptance of surfaces expect as qualified herein. For surface preparation of structural steel and miscellaneous metal surfaces, refer to the appropriate Section's work and Chapter 10 of CPCA/MPDA Manual (latest edition).

3.2 PREPARATION OF SURFACES

.1 Mildew Removal: scrub with solution of TSP and bleach, rinse with clear water and allow surface to dry completely.

.2 Galvanized Steel: remove surface contamination, wash metal with xylene solvent and apply coat of an approved etching type primer. (For doors, frames, ducts, piping, eaves troughs and flashing).

.3 Zinc Coated Steel: remove surface contamination and prepare surface to material manufacturer's instructions for priming.

.4 Masonry and Cement Type Surfaces (brick, concrete, concrete block, stucco, cement render, etc.): remove dirt, loose mortar, scale, powder and other foreign matter. Remove oil and grease using a solution containing TSP, then rinse and let dry. This is NOT to be construed to include cleaning, chipping or grinding of protrusions or filling of "honeycomb" holes, etc. which is to be carried out under Division 3.

Treat surfaces which are very smooth or have traces of form oil or parting compounds with acid-detergent treatment and wash with water. Remove powder, chalking, and oxidizing.

Remove concrete stains caused by weathering of corroding metals using a solution of sodium metasilicate after being thoroughly wetted with water. Let dry.

.5 Structural and Miscellaneous Steel (Factory Primed): ensure surfaces are in a proper condition to receive paint finish with grease, rust, scale, dirt and dust removed. Where steel and iron have a heavy coating of scale, remove by wire brushing, sandblasting, etc., as necessary. Ensure steel surfaces are satisfactory before proceeding with painting finishing. Touch up primer where necessary.

.6 Piping, Plumbing and Duct Work: treat galvanized surfaces with acetic acid, sal soda or other approved solution, wash with clear water. Scrape, wire-brush the surfaces to remove mill scale, rust; clean with solvent to remove dirt, oil, grease; where solder flux has been used, clean with benzine. After installation and before final painting of equipment and accessories which are factory primed, clean surfaces and touch up bared or marred spots with same finish as primer.

.7 Stainless Steel: clean pipe with acid pickling solution as recommended by pipe manufacturer.

.8 Steel Pipe: prepare surfaces to SSPC-6.

3.3 APPLICATION

.1 General

.1 Use method of paint application by the accepted trade method.

- Painting coats specified are intended to cover surfaces satisfactorily when applied in strict accordance to manufacturer’s recommendations.
- Apply each coat at the proper consistency.
- Ensure each coat of paint is slightly darker than preceding coat, unless otherwise approved.
- Sand lightly between coats to achieve an anchor for the required finish.
- Do not apply finishes on surfaces that are not sufficiently dry.
- Ensure each coat of finish is dry and hard before a following coat is applied unless the manufacturer’s directions state otherwise (e.g. see polyurethane coatings).
- Tint filler to match wood when clear finishes are specified; work filler well into the grain and before it has set, wipe the excess from the surface.
- On exterior work, do not paint during temperatures under 5°C or immediately following rain, frost or dew; on interiors do not paint during

temperatures under 5°C or on surfaces where condensation has formed or is likely to form (unless specially formulated paints are used). The minimum temperatures allowed for Latex paints shall be 7°C (interior work) and 10°C (exterior work) UNLESS specifically approved by the Engineer.

.2 Priming and Backpriming

.1 Backprime exterior woodwork which is to receive a paint finish upon arrival at the job site with exterior primer paint, stain or varnish, depending on the finish.

.2 Backprime interior woodwork which is to receive a paint or enamel finish upon arrival at the job site with enamel undercoating paint.

.3 Reduce stain, or gloss varnish as per manufacturer's directions.

.4 Prime top and bottom edges of wood and metal doors with under coating, stain or varnish, depending on the finish specified.

3.4 FIELD QUALITY CONTROL

.1 Provide alkali content tests. Use pink litmus paper for testing surfaces for alkalinity. Where extreme alkali conditions occur, neutralize surfaces by washing. Wash will consist of a 4% solution of Zinc Sulphate (NOT ON SURFACES THAT ARE TO RECEIVE LATEX PAINTS).

3.5 CLEANING

.1 Promptly as the work proceeds and on completion of the work, remove paint where spilled, splashed or spattered; during the progress of the work, keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris; at the conclusion of the work, leave the premises neat and clean to the satisfaction of the Paint Inspector and the Engineer.

3.6 PROTECTION

.1 General: adequately protect surfaces from paint and damage and make good any damage caused by this Section by failure to provide suitable protection.

.2 Drop Cloths: furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling completed or existing surfaces and in particular, surfaces within the paint storage and preparation area.

.3 Removal of Flammable Rubbish: place cotton waste, cloths and material which may constitute a fire hazard, in closed metal containers and remove from the site daily.

.4 Protection of hardware: remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. Carefully store, clean, and replace these items on completion of work in each area. Do not use solvent to clean hardware which will remove the permanent lacquer finish on some of these items.

3.7 PAINTING AND FINISHING SCHEDULE

.1 The following titles and code numbers refer to the Canadian Painting Contractors Architectural (CPCA) (or MPDA) Painting Specification Manual, latest edition, unless otherwise indicated for type of coating, grade, named products and manufacturers.

.2 Exterior painting and finishing schedule - Reference CPCA - Chapter 4A.

a) Galvanized Metal (flashing, doors and frames,
NOTE: other galvanized metal work to remain uncoated)

Premium Grade Ex. 12-A Alkyd Finish
Touch up with galvanizing primer where shown on drawings - Zinga or Galvacon.

b) Steel O/H doors Premium Grade Ex. 12-D acrylic finish.

.3 Interior painting and finishing schedule - Reference CPCA - Chapter 4B.

a) Wood Doors INT. 1-E stain and clear lacquer custom grade.

b) Cabinets INT 1-A Alkyd finish custom grade.

c) Plaster and drywall INT. 4-A Alkyd Finish

d) Concrete, Concrete Block (Note: Applies to walls and ceilings. Not floors.)

- Premium Grade INT. 7-B Alkyd Finish

e) Structural and Miscellaneous Metal (Factory Primed) (structural steel, crane beams, louvres, air handling units)

- Premium Grade INT. 13-A Alkyd Finish

f) Galvanized Metal Zinc Coated Steel (ducts, pipes, doors, frames, louvres)

- Premium Grade INT. 13-A Alkyd Finish

g) Plumbing and ducts

- For concealed non-insulated ferrous metal piping and ducts, hangers, supports, grilles, registers, other ferrous metal work, except that which is galvanized, apply one coat asphalt paint; coat parts which will be inaccessible for painting before installing them. (Note: major piping 75 mm diameter and larger is scheduled separately below.)

h) Major Piping, Valves, Pumps, Fittings, Couplings, Adapters and Associated Appurtenances

i) Touch Up of Existing Coatings

- This shall apply to all manufactured valves, couplings, pumps and mechanical equipment which are supplied with manufacturer's coatings which are unknown or do not conform to the pipe coating specification herein.
- Clean all specified surfaces to SSPC-SP-2 (hand tool cleaning).
- Apply two coats of industrial enamel as described below.

ii) Top Coats

- Ensure that all surfaces to be coated are clean and grease free.
- Touch up any damage to the zinc chromate primer.
- Spray apply two complete coats (5 mils minimum dry film thickness) of alkyd resin base BAPCO 39-000 Industrial Enamel or approved equal.
- Submit colour chips for selection by the Corporation.

.4 Concrete Block

.1 Apply one coat of thinned two component epoxy designed for priming of masonry surfaces, dry film thickness of 1 - 2 mils.

a) Intergard high gloss finish E H series/EHA000 thinned 30% by volume (International Paint).

b) Amerlock 400 high solids epoxy thinned 25% by volume (General Paint) or approved equal.

.2 Apply one coat of high build mastic to a minimum dry film thickness of 6 mils.

a) Intergard high build mastic E X series/EXA208 (International Paint).

b) Amerlock 400 high solids epoxy (General Paint) or approved equal.

.5 Touch up of manufacturer's coatings (over running crane, air supply and exhaust units, motors, electrical cabinets and all other equipment supplied with manufacturer's coatings and not otherwise requiring coating under this section).

.1 Touch up to repair all damage during shipping and construction.

.2 Protect all tags, signs and nameplates and ensure that paint is not applied to any uncoated surfaces.

.6 Piping Systems

.1 Piping systems shall be painted in accordance with the specified colour code.

.2 All items including valves, couplings, and fittings in a piping system shall be painted.

3. Pipe that has surface preparation and priming in a shop, shall be touched up, shall have welds cleaned and shall be painted in accordance with the applicable item in the schedule of painting systems.

.4 Valves, couplings and other items in a piping system may be supplied primed or shop finished. Such items shall be touched up as necessary and finish coated to match the piping system.

.5 Where the factory prime or finish coat consists of a material or materials not known, the surfaces shall first be prepared in accordance with SSPC-SP-6; and reprimed with a primer that is compatible with the finish coat.

.6 Where carbon steel, cast iron or ductile iron valves, couplings or fittings are installed in plastic, fibreglass or stainless steel piping systems, the metal items shall be painted in accordance with the applicable items in the schedule of painting systems to match the colour code.

.7 Apply one coat of primer, Valspar 13-Y-602 Epoxy Esler Valchem Phenolic primer, or approve equivalent.

.8 Apply two coats of finish, Vaspar 28 Series Chlorinated Valchem Rubber Brand, or approved equivalent.

.9 Apply paint to manufacturer's recommendations.

3.8 PAINTING AND COLOUR CODE

.1 Definitions

a) Piping systems shall include pipes of any kind, fittings, valves and pipe coverings.

b) Hazardous materials are materials which are flammable, explosive, corrosive, chemically active, toxic, productive of poisonous gases, or at high temperatures or pressures.

c) Fire quenching materials include CO_2 chemical foam, sprinkler systems and all other fire fighting and related equipment.

d) Safe materials shall include materials that hold little or no hazard to personnel or property.

e) protective materials shall include all materials used to prevent or minimize the hazards of dangerous materials by excluding fire quenching materials.

.2 Identification

a) All piping systems shall be identified by colour and by legend. Where colour bands are used instead of continuous colour for identification, the legend shall be placed on the coloured bands.

b) Piping identification shall be positioned every 10 metres on straight runs of pipe, at all changes of direction, and on both sides of equipment, valves, junctions, walls, floors, or ceilings.

c) The legend shall consist of stenciled letters giving the name of the contents in full or in abbreviated form. Temperature, pressure, an arrow indicating direction of flow, and similar information should be included when pertinent. The legend letters shall be positioned upright and normal to the operators viewing point whenever possible. Letters shall be stenciled in an approved, easily readable style of lettering.

d) The size of legend letters and colour bands shall be as outlined in Table 1 below or as directly by the Engineer. For smaller diameter pipes use a permanently legible tag. Under special conditions the Engineer may approve wall markings or alternative means of identification. Stainless steel piping shall be identified by letters identifying contacts and flow direction arrows.

TABLE 1 - SIZE OF LEGEND LETTERS

Outside Diameter of Pipe or Covering	Length of Colour Field	Size of Letters
mm	mm	mm
19 to 32	200	10
38 to 51	200	20
64 to 190	300	30
200 to 250	600	60
over 250	800	90

e) The colours for identification of piping systems shall be as outlined in Section 11910.

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 Division 23 Common Work Results for HVAC shall govern the Division 22 Plumbing sections of the work (read in conjunction with Division 1). This section covers items common to Division 22 series sections and is intended only to supplement the requirements of Division 1 and 23.

.3 Refer to Section 23 99 60 Mechanical Forms and submit all documentation therein that is applicable to Division 22 Plumbing.

1.2 RELATED WORK

.1	Concrete	Division 3
.2	Trenching and Backfilling	Division 33
.3	Piped Utilities	Division 33
.4	Electrical	Division 26

1.3 COORDINATION

.1 Systems indicated in Division 22 sections, located inside and/or buried beneath and/or on the roof of the building shall extend to a point 900 mm [36"] beyond the exterior face of the building.

.2 Plumbing drawings are diagrammatic and approximately to scale. They establish the scope of the work and the general location and orientation of the plumbing systems. The systems shall be installed generally in the locations and generally along the routings shown, close to the building structure and coordinated 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.

1.4 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Installation, workmanship and testing shall conform to the following standards:

.1 British Columbia Building Code

.2 Local Building By-Laws

1.5 LOW LEAD CONTENT

.1 All materials that come in contact with the water flowing through the faucet, piping, or valves shall be certified as “lead-free” as required by the provincial building code, CSA Standards, NSF-372 and NSF 61.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 and Division 23.

.2 Shop drawings are required for all materials and equipment including, but not limited, to the following:

.1 Floor drains.

.2 Hot water tanks and heaters.

.3 Hydrants/hose bibbs.

.4 Plumbing fixtures.

.5 Emergency fixtures.

1.7 RECORD DRAWINGS

.1 Provide project record drawings for all plumbing systems as specified in Section 23 05 00 Common Work Results for HVAC.

1.8 OCCUPANCY DOCUMENTATION REQUIREMENTS

.1 Provide occupancy documentation for all plumbing work as specified in Section 23 05 00 Common Work Results for HVAC.

.2 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.

.1 Seismic restraint system letters of assurance Schedules B and C-B from the plumbing contractor's seismic restraint engineer.

.2 Backflow Prevention Assembly Test Reports for each backflow prevention device, signed by the tester.

.3 Copies of pressure test reports for all piping systems on contractor's letterhead.

.4 Chlorination certificates for potable water systems.

.5 Plumbing inspector's final certificate.

.6 Maintenance manuals for plumbing systems.

1.9 SITE UTILITY SERVICES

.1 Required connections are:

.1 Water connection for the domestic water system.

.2 Refer to the drawings for the general arrangement of connections to the municipal or utility service systems.

1.10 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.

1.11 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.

1.12 SOIL CONDITIONS

.1 All buried metallic (cast iron, ductile iron) pipe materials in direct contact with the ground material shall be hot asphalt coated on all exterior surfaces including all couplings prior to installation of bedding and backfill. Asphalting operating may be carried out with piping installed in place in trench on wooden blocks prior to bedding installation.

1.13 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 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.

.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 Unfinished concrete area cleanouts shall be of heavy-duty construction and have a fully exposed scoriated cover. Standard of Acceptance: Zurn Z1400, Jay R. Smith 4229, Watts, Mifab

2.3 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 (i.e. 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 Expansion and Contraction and Building Seismic Joints:

.1 Support piping to prevent any stress or strain.

.3 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 CLEANOUTS

.1 Install cleanouts at the following locations:

.1 Fixture drain of a sink at intervals not exceeding 7.5 metres [25'] for pipe all sizes.

.2 As called for by the applicable codes.

.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 enough 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 gasketed waterproofed tops.

3.3 HANGERS AND SUPPORTS

.1 Refer to section 22 05 29 for Hangers and Supports for Plumbing Systems.

3.4 PIPE SLEEVES AND ESCUTCHEONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.5 CUTTING, PATCHING, DIGGING, CANNING, AND CORING

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.1 MISCELLANEOUS METALS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.2 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.

3.3 TESTING AND INSPECTION

.1 Furnish all labour, materials, instruments, etc. necessary for all required tests. All work shall be subject to inspection by local plumbing inspector and review by the Consultant. At least forty-eight (48) business hours [2 business days] notice shall be given 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.

3.4 PROJECT PHOTOGRAPHS

.1 The Contractor shall provide digital photographs in “jpeg” format to the Consultant complete with a text description or each photograph including the date, system type, materials used, and location/direction for all sections of underground piping pros to backfilling. Submit the photographs via email and/or disc as requested by the Consultant.

.2 Provide additional digital photographs of the work as requested by the Consultant to assist in the resolution of RFIs, prior to covering the work.

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 Refer to Section 23 05 20 Thermometers and Pressure Gauges for HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 20 provide thermometers and pressure gauges on all plumbing piping systems and equipment including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Tanks and other equipment.

.3 Provide thermometers in brass or stainless-steel wells at all water heaters and other equipment intended to change the temperature of the fluid.

.4 Provide pressure gauges complete with isolation ball valves on both sides of all pressure reducing valves, backflow prevention stations, and other equipment intended to change the pressure of the fluid.

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 Refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 The contractor is to arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all anchors and anchor supports to the structure required for the project. Submit details for approval.

.3 In addition to the piping, equipment and systems listed in Section 23 05 29 provide hangers and supports on all plumbing piping and equipment including:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Sanitary waste and venting.
- .4 Tanks and other equipment.
- .5 Under-slab piping where the building is on piles, or supported by other structural systems, or where called for on the drawings or in other sections of the specification.

.4 Hangers, threaded rods, nuts and associated components for hanging of under-slab piping shall be stainless steel and shall be fixed to the foundation or structural slab.

.5 Spacing of hangers shall comply with B.C. Building Code.

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 Refer to Section 23 05 49 Seismic Restraint Systems for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 49 provide seismic restraints on all plumbing piping and equipment including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Sanitary waste and venting.

.4 Tanks and other equipment.

1.3 DOCUMENT SUBMITTALS

.1 Provide letters of assurance signed and sealed by the contractor's specialist registered Professional Engineer.

.2 The contractor's Professional Engineer shall provide field reviews of the work on site as the work progresses and submit signed copies of the reports to the Consultant.

.3 The contractor's Registered Professional Engineer shall provide signed and sealed Province of BC Building Code Letters of Assurance Schedule B and Schedule C-B for the project.

.4 Submit Schedule B to the Consultant and to the local Authority Having Jurisdiction at the time of the shop drawing submission.

.5 Submit Schedule C-B to the Consultant and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

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 Refer to Section 23 05 53 Identification for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 53 provide identification on all plumbing piping, valves and equipment including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Sanitary waste and venting.

.4 Tanks and other 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 Refer to Section 23 05 93 Testing, Adjusting & Balancing for HVAC. Comply with all requirements of that Section of work as related to General Requirements, Products and Execution.

.3 Also refer to Section 22 08 00 Commissioning of Plumbing Systems.

1.2 SCOPE OF WORK

.1 In addition to the piping, equipment and systems listed in Section 23 05 93 provide testing, adjusting and balancing for all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Sanitary waste and venting.
- .4 Tanks and other equipment.

.2 Pressure test all plumbing piping systems in accordance with the specific requirements of the specification sections that describe those systems.

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 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the B.C. Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with NRC National Energy Code of Canada for Buildings (NECB).

1.3 SCOPE OF WORK

.1 Refer to Section 23 07 19 HVAC Piping Insulation. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping and systems listed in Section 23 07 19 provide piping insulation on all plumbing piping systems including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Sanitary waste and p-traps.

.4 Provide foil faced flexible insulation on components requiring adjustment or servicing including booster pumps, meter sets, pressure reducing valves, valve bodies, strainers etc.

.5 Sanitary vent stacks for the last 3 meters [10 feet] prior to penetrating the roof or penetrating a cold attic or similar space.

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 Refer to Section 23 08 00 Commissioning of HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 08 00 provide commissioning of all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Sanitary waste and venting.
- .4 Tanks and other equipment.

.3 Commissioning related to plumbing systems shall include the start-up, set up, adjustment and recording of the operational data of at least all the following systems and components as related to the project:

- .1 Incoming municipal water pressure.
- .2 Pressure reducing valve set points and downstream pressures.
- .3 Domestic water heater temperature set points.
- .4 Individual tepid water mixing valve set points.
- .5 Testing and certification of all backflow preventers.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section contains requirements for the following systems:

.1 Domestic water systems include 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.

.2 All pipe, pipe fittings, valves and accessories that come in contact with drinking water shall be lead-free and compliant with NSF 61 Annex G and Section 9, or NSF 372.

1.2 RELATED REQUIREMENTS

.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 Cross Connection Control

.1 All installations shall be in accordance with the recommendations contained in the latest edition of the Cross-Connection Control Manual published by Pacific Northwest Section of the American Water Works Association.

.2 Double check valve assemblies and reduced pressure principal backflow prevention devices shall have approval from the Foundation for Cross Connection Control, University of Southern California.

.3 Vacuum breakers shall conform to the requirements of C.S.A. B64.10.

.4 Following installation, a test report completed by a certified tester shall be submitted to the Owner, indicating satisfactory operation of each device.

.5 Tests are to be conducted in the period 30 to 60 days prior to date of Substantial Completion.

.6 Provide one repair kit for every cross-connection control device installed.

1.3 SOLDER AND FLUX

.1 All solder joints shall comply with ASTM B828 2002. Flux shall comply with ASTM B813 2010.

1.4 LEAD-FREE COMPLIANCE

.1 All potable water pipes, pipe fittings, plumbing fittings, faucets, solder, and flux to connect plumbing pipe to be California AB1953 or NSF 61, Annex G, Section 9, or NSF 372 compliant.

.2 All solder joints shall comply with ASTM B828 2002. Flux shall comply with ASTM B813 2010.

.3 No paints containing lead or cadmium.

Part 2 Products

2.1 PIPE AND FITTINGS

.1 Buried water pipe and fittings inside the building:

.1 75 mm [3"] and smaller.

.1 Polyethylene (PE) water pipe series 160 to CSA B137.1-M

.2 Polyvinyl chloride (PVC) Schedule 40 pressure pipe to CSA B137.3 with socket fittings to ASTM D2466/D2467.

.3 Chlorinated polyvinyl chloride (CPVC) water pipe, fittings and solvent cement to CSA B137.6-M

.4 Type 'K' seamless soft copper tubing to ASTM B88 or copper pipe to ASTM B42 with cast brass or wrought copper fittings and silver soldered joints all encased in a polyethylene piping system.

.2 Above ground water pipe and fittings inside the building:

.1 Copper:

.1 Cold water:

.1 Type 'L' 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.

.2 Hot water:

.1 Type 'L' 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 Fittings

.1 Above ground copper water pipe fittings inside the building:

.2 Use of the 'T-Drill' system of joining copper piping is not acceptable.

.3 Cast brass or wrought copper solder joint pressure fittings with 95/5 Sn/Sb or Silvabrite 100 solder joints; or

.4 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.]

.5 Standard of Acceptance:

.1 Victaulic 'The Copper Connection System for Copper Tubing (CTS)' with 606 couplings, 600 Series fittings and 641 flange adaptors.

.6 Exception: Where compression fittings are required, they shall be to ANSI B16.22

2.2 VALVES (LEAD-FREE)

.1 Low Lead Content

.1 All potable water pipes, pipe fittings, plumbing fittings, faucets, solder, and flux to connect plumbing pipe to be California AB1953 or NSF 61, Annex G, Section 9, or NSF 372 compliant.

.2 All solder joints shall comply with ASTM B828 2002. Flux shall comply with ASTM B813 2010.

.3 No paints containing lead or cadmium.

.1 Gate: (for shut-off and isolation), bronze body, inside screw, rising stem, Class 125, ASME rated

.1 50mm [2”] and smaller:

.1 Standard of Acceptance:

.1 Soldered - Kitz 807, Toyo 207ALF

.2 Threaded - Kitz 808, Toyo 206ALF

.2 Ball: (in lieu of gate valves or as specified)

.1 50mm [2”] and smaller: forged brass body, stainless steel vented ball and stem, PTFE seat and seal, [325 psig at 212°F], ASME rated

.1 Standard of Acceptance:

.1 Soldered. - Kitz 869M

.2 Threaded - Kitz 868M

.3 Globe: (for throttling, bypass, and make-up applications), bronze body, inside screw, rising stem, Class 125, ASME rated

.1 50mm [2”] and smaller:

.1 Standard of Acceptance:

.1 Soldered. Kitz 812

.2 Threaded Kitz 811

.4 Swing Check Valves: (for horizontal installation only) Y-pattern, horizontal swing type, bronze body and disc, screwed cap, integral seat, Class 125, ASME rated

.1 50mm [2”] and smaller:

.1 Standard of Acceptance:

.1 Soldered. Kitz 823

.2 Threaded Kitz 822

.5 Pressure Reducing Valves

.1 6 mm [¼"] to 9 mm [3/8"] ,860 kPa [125 psig] rating, forged lead-free brass body, replaceable stainless-steel seat, 30 mesh stainless steel strainer, large diaphragm for superior performance at low flow conditions under 69 kPa [10psig].

.1 Standard of Acceptance:

.1 Watts LF215

.2 12 mm [½"] to 50 mm [2"], 860 kPa [125 psig] rating, lead-free brass body, replaceable stainless-steel seat, serviceable in-line, adjustable from 172 to 517 kPa [25 to 75psig], large diaphragm, spring cage and seat orifice for high-capacity performance, suitable for water supply pressures up to 2068 kPa [300psig].

.1 Standard of Acceptance:

.1 Watts LF223

.6 Strainers:

.1 75mm [3”] and smaller: wye-pattern lead free cast copper silicon alloy

.1 Standard of Acceptance:

.1 Watts LF777

.7 Vacuum relief: (for DHW tanks)

.1 Water service vacuum relief valves, lead free brass body, low profile, protective cap,

.1 Standard of Acceptance:

.1 Watts LFN36

.8 Drain Valves:

.1 50mm [2”] and smaller: forged brass body, stainless steel vented ball and stem, PTFE seat and seal, [325 psig at 212°F], ASME rated, complete with cap and chain.

.1 Standard of Acceptance:

.1 Threaded - Kitz 868M

2.3 VACUUM BREAKERS

.1 Pressure type:

.1 NSF-61 low lead cast bronze, protect against back siphonage of contaminated water into the water supply with upstream and downstream isolation valves and test cocks, spill resistant.

.1 Standard of Acceptance:

.1 Zurn 460XL

.2 Atmospheric type:

.1 Lead-free cast brass, polished chrome plate finish where exposed.

.1 Standard of Acceptance:

.1 Zurn 35XLPCH

.3 All vacuum breakers shall be sized in accordance with the following table:

Pipe Size mm [in.]	Pressure Type Size mm [in.]	Atmospheric Type Size
12 - 25 [½ - 1]	12 [½]	Full Pipe Size
30 - 40 [1¼ - 1½]	19 [3/4]	Full Pipe Size
50 - 75 [2 - 3]	25 [1]	Full Pipe Size

2.4 BACKFLOW PREVENTION STATIONS

.1 Double check valve assembly, factory assembled station

.1 Comply with CAN/CSA-B64.10 and CAN/CSA-B64.10.1

.2 Provide spare repair/maintenance kit

.3 12 mm [1/2"] to 50 mm [2”], 1206 kPa [175 psig] pressure rating

.1 Suitable for up to 82°C [180°F] water temperature

.2 Lead-free, cast bronze main body, nylon housing with stainless-steel struts.

.3 Full port inlet and outlet ball valves

.4 Top-mounted test ports

.5 Standard of Acceptance:

.1 Zurn 350XL

2.5 STRAINERS

.1 50 mm [2"] and smaller, wye-pattern, threaded ends, NSF-61 compliant cast bronze body and plug, stainless-steel screen, blow down outlet, epoxy coated removeable cover, 2068 kPa [300 psig] rating.

.1 Standard of Acceptance:

.1 Zurn SXL

2.6 WATER HAMMER ARRESTORS

.1 Bellows style with stainless steel casing and welded stainless steel nesting bellows, nitrogern and helium charged,air chambers are not acceptable.

.1 Standard of Acceptance:

.1 MiFab WHB

2.7 THERMOMETERS AND PRESSURE GAUGES

.1 Refer to Section 22 05 20 Thermometers and Pressure Gauges.

2.8 TEMPERATURE AND PRESSURE RELIEF VALVES

.1 A.S.M.E. rated for the energy input to the system and the pressure rating of the equipment.

.1 Standard of Acceptance:

.1 Watts, Cash Acme.

2.9 PIPE JOINTS

.1 Solders and fluxes having a lead content and self-cleaning acid type fluxes are not acceptable.

.2 All copper to steel or iron and flanged adaptors shall be brass, not copper.

.3 All unions or similar interconnections between dissimilar metals shall be dielectric couplings.

.1 Standard of Acceptance:

.1 Epco Dielectric Pipe Fittings, Victaulic dielectric waterway

2.10 AIR VENTS

.1 Automatic float type, 1035 kPa [150 psig] max. operating pressure.

.1 Standard of Acceptance:

.1 Armstrong 11-AV, Maid-o-Mist 71, Taco 426, Amtrol.

2.11 TRAP SEAL PRIMERS

.1 Flow Actuated Type:

.1 Provide flow actuated type priming device piped to nearest fixture so that device will introduce regulated amount of water into trap whenever fixture is used.

.2 Standard of Acceptance:

.1 Watts A200-T, Zurn, Watts, Jay R. Smith

2.12 WATER METER

.1 Arrange and pay for the supply and installation of the Water Meter.

.2 The water meter shall be supplied by the Contractor and shall be to Municipal Standards.

.3 Hermetically sealed direct reading centre sweep register, one piece cast bronze main case, nutating disc measuring chamber with flow control adjustment, magnetically driven, rated for 1035 kPa [150 psig] service, reading in cubic metres and flanged ends conforming to AWWA C700.

.1 Standard of Acceptance: Neptune Trident 8, Rockwell, Hersey

.4 Self-generating remote meter reader to suit municipal requirements. Provide EMT conduit from the water meter location to the remote reader location.

Part 3 Execution

3.1 BUILDING WATER ENTRY

.1 Provide concrete thrust blocks at all changes of direction of underground piping, including underslab piping. Provide thrust blocks at fittings where an essentially horizontal water main turns up through a slab into the building.

.2 Provide galvanized tie rods from the below slab piping and connect to the first pipe flange within the building. Where corrosive soils are present utilize stainless steel tie rods and associated washers and nuts.

.3 Provide sleeves where pipes penetrate foundation walls or building slabs or other concrete members.

.4 Seal penetrations water tight using non-hardening mastic where there is no hydraulic pressure.

.5 Provide mechanical seal such as Link Seal where hydraulic pressure may occur.

3.2 VALVE INSTALLATION

.1 Where possible, disassemble solder end joint valves before soldering.

.2 Where disassembly and the subsequent reassembly is not possible, the contractor shall give special regard to solder jointing in order not to damage, melt or deform and valve parts.

.3 Shut Off Valves:

- .1 Install shut-off or isolation valves whether shown on the drawings or not at the following locations:
  - .1 At the point where the water service first enters the building.
  - .2 At each single plumbing fixture (i.e. normally this requirement is satisfied by the provision of the angle valve specified with the specific fixture).
  - .3 At each single piece of equipment.
  - .4 At all points as indicated on the drawings.
  - .5 At all points where the plumbing code requires same.

.4 Pressure Reducing Valves:

- .1 Pressure reducing valve stations, as a minimum shall consist of the following:
  - .1 A high flow or main pressure reducing valve; which shall be one pipe size smaller than the incoming or outflowing building service, and shall be provided with a strainer, a reducer, shut off valve and union on the inlet side and a union, reducer and a shut off valve on the outlet side.
- .2 Set main pressure reducing valve at 415 kPa [60 psig] outlet pressure.

.5 Drain Valves:

- .1 Install drain valves 18 mm [3/4"] minimum, or line size where the piping is smaller than 18 mm [3/4"].
- .2 Install a hose-end adaptor, cap and chain on the discharge side of each drain valve or pipe to drain where indicated.

3.3 VACUUM BREAKER INSTALLATION

.1 Install at each fixture or item of equipment where contamination of the domestic water system can occur.

.2 Vacuum breaker installation shall be in complete accordance with Clause 1.3 Cross Connection Control and with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.3 Vacuum breaker installation shall be in complete accordance with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.4 All atmospheric type vacuum breakers shall be installed at least 300mm [12"] above flood level rim of fixture.

.5 Complete testing of all vacuum breakers shall be carried out under this section of the work prior to final acceptance of plumbing systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

3.4 BACKFLOW PREVENTION STATION INSTALLATION

.1 Install at each fixture or item of equipment where contamination of the water system can occur.

.2 Backflow prevention stations shall be in complete accordance with CAN/CSA-B64.10 and CAN/CSA-B64.10.1 Manual for the Selection and Installation of Backflow Prevention Devices/Manual for the Maintenance and Field Testing of Backflow Prevention Devices.

.3 Complete testing of all double check valve assemblies and reduced pressure principle backflow prevention devices shall be carried out by a certified tester under this section of the work prior to final acceptance of plumbing systems. Submit a certificate for each device duly signed and witnessed that testing was successfully completed.

3.5 FLANGES AND UNIONS

.1 Provide on all connections reducing valves, fixtures, and equipment.

.2 Connections up to and including 50 mm [2"] size shall be all bronze union, 1,035 kPa [150 psig] rating with ground seat; larger connections shall be flanged.

3.6 PRESSURE GAUGES

.1 Install pressure gauge at each pressure reducing station inlet and outlet.

3.7 WATER HAMMER ARRESTORS

.1 Size in accordance with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.

3.8 THERMOMETERS

.1 Install at domestic hot water storage tank inlet and outlet.

.2 Locate for ease of readability and such that their sensing elements are directly in the flowing medium and immediately adjacent to the sensing elements.

.3 When installed to sense the water temperature in a pipe; install its sensing element in a non-ferrous, separable well filled with a heat conducting paste. Install the separable well in a form which minimizes the restriction to water flow; if necessary, in a section of oversized pipe.

3.9 PIPE JOINTS

.1 Install dielectric type couplings where copper piping and accessories connect to plumbing equipment such as steel storage tanks, pressure reducing stations and ductile iron pipe.

.2 Where the water service enters the building terminate at the edge of the building and excavation with a Smith Blair standard sleeve coupling having stainless steel nuts and bolts. Bridge the excavation with ductile iron pipe.

.3 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.

.4 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.

3.10 AIR VENTS

.1 Install at all high points in domestic hot water recirculation system.

.2 Install on tees and not on horizontal piping or radiused elbows.

.3 Install 12 mm [½"] minimum isolating gate valve ahead of each air vent.

.4 Pipe all air vent discharge connections separately to nearest building drain using 6 mm [¼"] hard drawn copper.

3.11 HYDRANTS AND/OR HOSE BIBBS

.1 Provide operating keys to the Owner for all hose bibbs that do not possess an attached handle.

.2 Provide an isolating shut-off valve upstream of all hose bibbs.

.3 Seal around the perimeter of hose bibs with silicone caulk in a neat manner, for a waterproofing seal. Where a water proof membrane is present, provide a hose bibb with a membrane clamp.

3.12 TRAP SEAL PRIMERS VALVES

.1 Provide floor drain trap primers in accordance with the plumbing code and as designated on the drawings.

.2 Locate at locations that are readily accessible by the building maintenance staff.

3.13 WATER METERS

.1 Approved meter rooms must provide vehicular access allowing 3 meters [10’] vertical clearance from the City roadway to the water meter station.

.2 Install at the location depicted on the drawings.

.3 Provide a strainer on the inlet to the water meter between the inlet valve and the water meter.

.4 Provide isolation valves on the inlet to and outlet from the water meter with a valved bypass around the water meter connected to the water system upstream of the inlet valve and downstream of the outlet valve.

.5 Wiring and conduit to remote reader by this section of the work.

.6 Provide a test report from an independent test agency to verify that the meter and reader have been installed and set to read within the acceptable limit of accuracy as set out in AWWA standards.

3.14 TESTING AND INSPECTION

.1 Testing shall consist of hydraulic pressure testing at 1,400 kPa [200 psig] for 8 hours.

.2 Submit signed and dated pressure test reports for all sections of the water distribution systems.

3.15 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.

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 Provide domestic water heaters as depicted on the drawings.

1.3 LOW LEAD CONTENT

.1 All materials that come in contact with the water flowing through the faucet, piping, or valves shall be certified as “lead-free” as required by the provincial building code, CSA Standards, NSF-372 and NSF 61.

Part 2 Products

2.1 DOMESTIC WATER HEATER – PACKAGED TANK TYPE

.1 Glass-lined, electric hot water heater and tank, 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 Performance:

.1 Refer to equipment schedule on drawings.

.6 Standard of Acceptance: A.O. Smith Model DRE-xxx

2.2 EXPANSION TANK FOR HOT WATER SYSTEM

.1 Carbon steel expansion tank of welded construction, ASME construction, stainless steel connection, heavy duty butyl diaphragm, rigid polypropylene liner and integral floor stand, NSF-61 listed for potable water systems.

.2 Equipment Schedule:

.1 Total volume: 16.6 litres [4.4 USgal]

.2 Acceptance Volume: 12.1 litres [3.2 USgal]

.3 Standard of Acceptance: Amtrol Therm-X-Trol ST-12

Part 3 Execution

3.1 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 Instruments with external electric wiring to be isolated from heaters and tanks with dielectric bushings or dielectric unions

.4 Install thermometers at domestic hot water storage tank inlet and outlet.

.5 Provide vacuum relief valve and check valve on cold water supply.

.6 Provide isolating valves at all tank and heater water connections.

.7 Provide a corrosion resistant water tight pan under any hot water heater/storage tank in compliance with the B.C. Plumbing Code and local by-laws.

.8 Galvanic isolation to be provided on all connections from domestic hot water tank which transition from stainless steel to other metals.

3.2 TESTING AND INSPECTION

.1 Testing shall consist of hydraulic pressure testing at 1,400 kPa [200 psig] for 8 hours.

.2 Submit signed and dated pressure test reports for all sections of the water distribution systems.

3.3 FLUSHING AND CHLORINATION

.1 On completion of installation and testing, tank and all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C-601.

.2 Retain a reputable firm qualified to supervise and inspect the chlorination and flushing procedures and perform chemical biological tests as required.

.3 Chlorinate 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.

.4 Submit to the Consultant a certificate from the testing firm stating that chlorination and flushing has been successfully completed.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Interior sanitary waste and vent piping shall be provided as depicted on the drawings to plumbing fixtures that will discharge sanitary waste and shall be connected to discharge to the waste treatment facility as depicted on the drawings.

1.2 RELATED REQUIREMENTS

.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 Refer to and comply with the following sections:

.1	Bidding Requirements and General Conditions of Contract	Division 00 and Division 01
.2	General Mechanical Provisions	Division 23
.3	Codes, Bylaws, and Standards	Division 23
.4	Documentation and Submittals	Division 23
.5	Commissioning and Demonstration	Division 23
.6	Hangers, Supports and Anchors	Division 23
.7	Mechanical Forms	Division 23
.8	Excavation, Trenching and Backfilling	Division 33

1.3 APPLICABLE CODES AND STANDARDS

.1 Refer to Section 23 05 00, Codes, Bylaws and Standards.

1.4 SUBMITTALS

.1 Shop Drawings

.1 Submit shop drawings in accordance with Division 1 and Division 20.

.2 Shop drawings are required for all materials and equipment.

Part 2 Products

2.1 INTERIOR DRAIN, WASTE AND VENT PIPE AND FITTINGS

.1 Buried pipe and fittings:

.1 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings conforming to CSA B181.2.

.2 Above ground pipe and fittings:

.1 Class 4000 cast iron mechanical joint pipe and fittings with mechanical joint stainless-steel couplings to CSA CAN3-B70 up to 200 mm [8"].

.2 DWV copper drainage pipe with cast brass or wrought copper drainage pattern fittings with recessed solder joints.

.3 Additional Requirements

.1 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab.

.2 Class 4000 mechanical joint cast iron soil pipe, fittings and mechanical joint couplings shall be of one manufacturer.

.3 Copper to cast iron joints shall be male brass adaptors to tapped fittings.

.4 Nipples shall be cast iron or heavy brass.

2.2 FLOOR DRAINS

.1 Floor drains connected to the sanitary system shall include trap primer connections.

.2 Refer to equipment schedules on the plans for floor drain types.

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.

.4 Water piping from trap primer to floor drain to be PEX tubing where cast into concrete and protected in a polyethylene sleeve where buried below slab. Provide Type L copper where exposed within the building.

3.2 SAFES, FLASHING AND VENT TERMINALS

.1 Terminate all vent terminals a minimum of 25 mm [1"] above the water level at which roof drainage overflows through roof overflow scuppers or drains.

.2 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m ² [5 lb/ft²] lead.

.3 Supply and fix 25 kg/m² [5 lb/ft²] sheet lead flashings to all cleanouts and drains. Securely fix to flashing clamps and extend 300 mm [12"] beyond edge of cast iron fittings.

.4 Vent flashing minimum 450 mm x 450 mm [18" x 18"] base dimension shall terminate flush with the top of 300 mm [12"] high vent pipe and the gap between the flashing and pipe shall be closed with a 25 kg/m² [5 lb/ft²] separate lead cap 75 mm [3"] high. The main flashing shall not be turned over the pipe.

3.3 PIPING

.1 Do not install piping with glued joints at temperatures below those recommended by the solvent manufacture.

3.4 TESTING AND INSPECTION

.1 Tests on the sanitary waste and storm drainage systems 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 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 CODES AND STANDARDS

.1 All fixtures shall display CSA (Canadian Standards Association) approval where a CSA standard is available and in effect.

.2 Plumbing fittings shall be certified to CAN/CSA B125, Plumbing Fittings.

.3 Plumbing fixtures shall be certified to CAN/CSA B45, 'General Requirements for Plumbing Fixtures',

.4 Stainless steel plumbing fixtures shall be certified to CAN/CSA B45.4, 'Stainless Steel Plumbing Fixtures'.

.5 Emergency showers and eye washes shall be certified to ANSI Z358.1 American National Standard for Emergency Eyewash and Shower Equipment.

1.3 COLOUR

.1 Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.

.2 Exposed plumbing brass and metal work shall be heavy triple chromium plated.

1.4 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.

1.5 LOW LEAD CONTENT

.1 All materials that come in contact with the water flowing through the faucet shall be certified as “lead-free” as required by the provincial building code, CSA B125.1, CSA B125.3, NSF 372 and NSF 61

Part 2 Products

2.1 EMERGENCY SHOWERS

.1 Refer to plumbing fixture schedule on the drawings.

2.2 SINKS

.1 Provide braided stainless-steel flexible supplies for sinks. Supplies for sinks shall incorporate 12 mm [1/2”] chrome plated quarter turn mini ball valve stop.

.2 Refer to plumbing fixture schedule on the drawings.

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.

.3 Provide chrome plated quarter turn mini ball valves for all lavatories, sinks and tank type water closets.

.4 ABS p-traps and waste arms are not permitted.

.5 Lavatories and Sinks

.1 Provide braided stainless-steel flexible supplies for sinks, drinking fountains and lavatories.

.1 Supplies for sinks shall incorporate 12 mm [1/2”] chrome plated quarter turn mini ball valve stop.

.2 PEX or other plastic supplies are not acceptable.

.3 Double waste fittings for lavatories and sinks shall be a double sanitary tee.

.4 Control handles for all two handle mixing faucets shall be positioned with the cold control on the right and the hot control on the left. Activation shall be accomplished by rotating the cold control handle clockwise and the hot control handle counterclockwise.

.5 Faucets shall be complete with nuts and tailpieces.

.6 Provide appropriate gaskets and/or sealing washers that will prevent the entry of water into fixture trim or faucet holes or punchings in millwork.

.7 Gooseneck spouts shall have a clearance of 200 mm [8"] from nozzle tip to countertop, unless otherwise specified.

.8 Plastic control handles and spouts are unacceptable.

.9 Lavatory and sink P-traps shall be cast brass or tubular brass complete with either a cleanout or possess slip joint connections. Assembly shall be chrome plated where not concealed in millwork. Plastic drain and trap assemblies are not acceptable.

.10 Lavatory and sink P-traps shall be complete with either a cleanout or possess slip joint connections.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixture punchings for faucets or other trim shall not contain more punchings than necessary for the specified trim.

3.3 WALLS AND FLOORS

.1 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with Dow Corning anti-mildew 786 building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 WATER HAMMER ARRESTORS

.1 Provide water hammer arrestors or shock absorbers on fixtures with flush valves and/or quick closing valves.

3.5 EMERGENCY SHOWERS AND EYE WASHES

.1 Emergency Showers and Eye Washes shall be field tested for compliance with ANSI Z358.1 American National Standard for Emergency Eyewash and Shower Equipment.

.1 Provide documentation certifying the test results and compliance with the noted standard.

END OF SECTION

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
BACKFLOW PREVENTERS	Ames, Apollo, Febco, Watts, Zurn	X
BALANCING, COMMISSIONING, MAINTENANCE MANUALS	REFER TO DIV. 23	X
DRAINAGE PRODUCTS cleanouts, drains, hose bibs, water hammer arrestors	Mifab, Jay R.Smith, Watts, Zurn, Wade	X
EMERGENCY EYE WASH & SHOWERS	Acorn, Bradley, Guardian, Haws	X
FAUCETS	Acorn, Alsons, American Standard, Bradley, Cambridge, Chicago, Crane, Delta, Grohe, Kohler, Moen, Powers, Sloan, Symmons, TOTO , T&S Brass, Zurn	X
FIXTURES		
stainless steel	Acorn, AMI, Bradley, Franke, KIL, Kindred, Steel Queen	X
HANGERS	REFER TO DIVISION 23	X
INSULATION		
piping & equipment	REFER TO DIVISION 23	X
below lavatories	ProWrap, Trubro	X
PIPE & FITTINGS		
cast iron	Bibby St Croix, Charlotte Pipe, Tyler Pipe	X
copper	Wolverine	X
ductile iron	Canada Pipe, Charlotte Pipe	X
PEX	IPEX, Rehau, Vanguard, Wirsbo [In-slab – Wirsbo only]	X
PVC	Canplas, IPEX, Royal	X
PIPE FITTINGS & COUPLINGS		

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
grooved end mechanical joint	Victaulic REFER TO DIVISION 23	X
PIPE CONNECTORS (FLEXIBLE)	REFER TO DIVISION 23 Mason Industries	X
PRESSURE RELIEF VALVES	Watts	X
SEISMIC RESTRAINTS	REFER TO DIVISION 23	X
TANKS		
DHW thermal expansion	Amtrol, Expanflex, B&G, Taco, Wheatley	X
VALVES		
brass, butterfly, cast iron	Crane, Apollo, Jenkins, Kitz, Nibco, Red & White/Toyo	X
fixture shut off	Brass Craft, Dahl	X
pressure reducing - water	Watts, Apollo, Clayton, Conbraco, Singer, Wilkins, Zurn	X
pressure & temperature relief	Watts	X
PVC	Chemtrol	X
WASTE FITTINGS	McGuire, OS&B, Teck	X
WATER HEATERS		
gas, electric, immersion	A.O. Smith, Giant, John Wood, Rheem, Rudd, P.V.I., Viessman	X

NOTES:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the Plumbing - Equipment Manufacturers Schedules.

.2 “X” - Denotes required submission.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Intent

1.1.1 The Electrical Requirements and the specifications bound herewith shall be subject to all the requirements of the General Conditions, the Supplemental General Conditions and the requirements of Division 01 – General Requirements, except that these Electrical Requirements shall take precedence over and modify any pages or statement of the Supplemental General Conditions and shall be used in conjunction with them as a part of the “Contract Documents”.

1.1.2 The word “supply” as used in these specifications shall be taken to mean that the so noted equipment is to be purchased, assembled, and shipped to the site. The supplier of the equipment is responsible to confirm functionality of equipment, on site prior to the commissioning of the system. Where an item is noted as supplied by Owner, by others, or by another division, the work of mounting, connecting, and commissioning the item shall be included in the contract unless specifically noted otherwise.

1.1.3 The word “provide” as used in these specifications shall be taken to mean that the so noted equipment is to be supplied, mounted, connected, commissioned, adjusted and placed into energized service.

1.1.4 The word “approved” as used in these specifications shall be taken to mean that the so noted equipment is to be reviewed by the Owner / Engineer prior to fabrication.

1.1.5 It is the intention of these specifications and drawings, to provide for a complete and fully operating electrical system, with facilities and services to meet the requirements described herein, and in complete accord with applicable codes, ordinances and standards.

1.1.6 The Electrical 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 electrical system, except when it is specifically mentioned that certain materials and/ or labour are not part of the contract.

1.1.7 All Electrical work must be coordinated with Divisions 25, 33, and Division 41. It is the Contractor's responsibility to coordinate the work of all Subcontractors on this project and to ensure that work covered under related Divisions is completed by qualified personnel.

1.1.8 A copy of the Division 26 – Electrical documents must be provided to the various process and mechanical system suppliers, to ensure their equipment meets the intent of the contract documents and specifications.

1.1.9 A separate version of the Division 26 Specifications has been provided to the packaged equipment vendors that are producing the owner supplied equipment.

1.2 Related Work

1.2.1 Refer to Division 01 for General Requirements related to the general contract.

1.2.2 Refer to Division 33 for process equipment and Division 41 for mechanical work related to the electrical installation.

1.2.3 Refer to Division 25 for work requirements related to instrumentation, automation, and controls systems.

1.2.4 Refer to Division 09 for finishes related to the electrical installation.

1.3 Codes and Standards

1.3.1 Do complete installation in accordance with the latest editions of Canadian Electrical Code CSA C22.1, as adopted by the Province of British Columbia (CEC), the B.C. Building Code, all Technical Safety BC amendments, and the Local Authority Having Jurisdiction, except where specified otherwise.

1.3.2 Perform underground systems in accordance with latest edition of CSA C22.3 No.7, except where specified otherwise.

1.3.3 All work shall be executed in accordance with the current codes, standards, statutes or recommendations of the following technical societies, trade organizations, and governing agencies, and shall be subject to the inspection of those departments having jurisdiction:

.1 Municipal Electric Ordinances;

.2 Canadian Electrical Code;

.3 BC Building Code;

.4 WorkSafe BC;

.5 Institute of Electrical & Electronics Engineers (IEEE);

.6 National Fire Protection Association (NFPA);

.7 National Electrical Manufacturers Association (NEMA);

.8 International Organization for Standardization (ISO);

.9 International Electro technical Commission (IEC);

.10 Canadian Standards Association. (CSA);

.11 Insulated Cable Engineers Association (ICEA);

.12 Illuminating Engineering Society of North America (IESNA).

1.3.4 Where work required by the drawings and specifications is above the standards required by these organizations or agencies, it shall be done as shown, or specified.

1.3.5 All fees, permits, licenses, etc., necessary in order to complete the work of this section shall be obtained and paid for under this contract.

1.4 Drawings and Specifications

1.4.1 The drawings and specifications shall be used together, and all materials and labour mentioned in one but omitted from the other shall be

considered as sufficiently specified and shall therefore be supplied and installed.

1.4.2 The locations of various items on the drawings are schematic, diagrammatic and approximate, unless specified otherwise, and are subject to slight revisions as the equipment is installed in order to accommodate construction conditions.

1.4.3 Where equipment and material dimensions are dependent upon building dimensions, take field measurements; do not scale the drawings.

1.4.4 The drawings are not intended to be scaled for roughing-in measurements or to serve as shop drawings.

1.4.5 The Contractor shall consult the architectural, structural, mechanical, and/ or equipment drawings for dimensions, obstructions, and location of equipment of all other trades. Any discrepancies between architectural, structural, mechanical, or equipment drawings and the work shown on the electrical drawings shall be reported to the General Contractor, for the Owner / Engineer to review and provide a decision, and where deemed necessary, the work shall be adjusted.

1.4.6 The installation details, instructions, and recommendations of the manufacturer of any product (modified only to obtain best end results), shall be the basis of attaining installation of the products for usage on this project, except where definite and specific instructions are set-forth herein, or details are shown on the drawings.

1.4.7 Outlet devices, switches, panels, fixtures and special equipment are shown on the drawings, only in a diagrammatic manner, and not necessarily in their specific location. The Contractor shall be responsible for exact locations of the outlets, to form a functional and aesthetic installation either by careful review of all architectural elevations, tile patterns, surface finishes, and equipment arrangements, or by consultation with the Owner / Engineer and the other trades involved.

1.5 Errors and Omissions

1.5.1 In the event of errors or discrepancies between the drawings and specifications, the Contractor shall obtain a ruling before quotations are submitted.

1.5.2 If a ruling has not been requested, it shall be assumed that in event of a discrepancy, the Contractor has allowed for the more expensive alternative.

1.5.3 Refer to subsection 1.4.1, above.

1.6 Compliance

1.6.1 Failure to comply with the drawings and specifications shall be cause for rejection and the Contractor shall be required to make good at no additional cost to the Owner, or their Agents, any remediation that may be required.

1.7 Shop Drawings

1.7.1 Provide shop drawings in accordance with the requirements of Section 01 30 00 - Submittals.

1.7.2 Shop drawings shall be submitted for all major equipment as designated in the “GENERAL” paragraph of each section of these specifications.

1.7.3 Shop drawings shall be first checked by the Contractor for space, dimension, performance characteristics and general conformance to these plans and specifications, and shall be so stamped with their company name. Shop drawings not stamped as specified will be returned to Contractor without action. The Contractor’s stamp shall include name and address of Contractor, the date checked, the initials of the checker and the status of the checking.

1.7.4 Shop drawing submittals shall be grouped according to specification section or categories and shall be labeled with the proper name of the project and specification section. Partial submittals of a group or category will not be reviewed (e.g., submit all lighting fixtures, all devices, all distribution equipment and motor control centres, with associated starters or drives, etc.)

1.7.5 Shop drawings shall include manufacturer’s name and address, equipment or material descriptive names, and a complete catalog number. Shop drawings shall indicate dimensions, voltage and current characteristics, wire sizes, test or conformance data, construction and rough-in data of all material to be used. Product sales brochures will not be accepted.

1.7.6 Submit shop drawings and/ or product literature for system components, as called below, but not necessarily limited to:

- .1 Distribution Equipment;
- .2 Motor Control Centre (MCC), Sections and Starters;
- .3 Moulded Case Circuit Breakers (MCCB);
- .4 Variable Frequency Drives (VFDs);
- .5 Panel boards, Transformers and Accessories;
- .6 Lighting Fixtures, Controls and Accessories;
- .7 Branch Devices, Switches, Receptacles, Wall Plates, Wall Boxes, Pull Boxes & Raceways;
- .8 Cable Trays, Conduits, Cables & Accessories;
- .9 Local Control Panel (LCP) and Associated Equipment;
- .10 Terminal and Wire Marking System;
- .11 Power Sources;
- .12 Field Instrumentation.

1.7.7 Shop drawings shall be clear, legible and submitted in colour. Fax copies are not acceptable. Electronic format (PDF files) are preferred, as these will be used in the close-out documentation, Operation & Maintenance Manual submission.

1.7.8 Submitted shop drawings shall be dimensioned.

1.7.9 Engineered shop drawings shall be submitted for MCC, including but not necessarily limited to: metering, Variable Frequency Drives, Starters, and feeder breakers.

1.7.10 The Engineers review includes for a general overview of shop drawings for conformity to project requirements in accordance with the construction agreement and does not relieve the Contractor of errors or discrepancies.

1.7.11 Allow ten (10) working days for the review and processing of shop drawings for each submittal.

1.8 Closeout Submittals

1.8.1 Refer to Division 01 - General Requirements including Section 01 77 00 – Closeout Procedures, for requirements for Operation and Maintenance Manuals.

1.8.2 Provide operating and maintenance information sheets for all equipment and arrange for their insertion into the Operation and Maintenance Manuals. The documentation shall include all applicable, descriptive and technical data, maintenance and operating procedures, wiring diagrams, spare parts lists, service representatives, and suppliers for replacement parts. The documentation shall be neatly, and orderly assembled in binders.

1.8.3 Requirements for operation and maintenance of process control and instrumentation equipment shall be as specified in the various sections of Division 26 - Electrical.

1.9 Drawings of Record

1.9.1 A minimum of One (1) complete set of construction drawings shall be kept at the construction site.

1.9.2 During the construction period, the Contractor shall keep on site a clean set of drawings marked up to reflect the "As-Built" state, for examination by the Engineer on a regular basis. Include elevations and detailed locations of buried services, empty conduit systems, junction boxes and pull boxes.

1.9.3 In addition, the Contractors marked up, “as-built” motor control schematics and associated field wiring for each motor, shall reflect the final connections completed during installation, testing, and commissioning of the motor control centres and VFDs.

1.9.4 Any and all changes to the construction of the project which deviate from the construction drawings shall be documented in their entirety for incorporation into a final Record Drawing set, which shall be issued by the Contractor at the completion of the project.

1.10 Coordination

1.10.1 Cooperate and coordinate with other trades on the project.

1.10.2 Make suitable arrangements with other trades to make provision for the electrical work and be responsible for the assurance that such provisions are satisfactory for the electrical work.

1.10.3 Check the drawings and specifications of other trades for conflict, and coordination with the electrical trade. If any conflicts are found, obtain a ruling from the Owner / Engineer before proceeding.

1.10.4 Contractor is responsible for coordinating the electrical work with the owners representative. The work is to be conducted in an energized and operating facility and any requirements for de-energization of operating equipment shall be at the discretion of the owner and facility operating staff.

1.11 Power Supplies

1.11.1 Provide all necessary power supplies, and dedicated circuits for other trades. Coordinate as required.

1.11.2 Power wiring to field devices shall be not less than #12 AWG, including instrumentation (unless loop powered).

1.12 Shipment, Protection and Storage

1.12.1 Deliver, store, and maintain packaged materials and product, with the manufacturer's seals and labels, intact. Written acceptance of receipt at delivery, by the Contractor, shall constitute "Delivery to Site" under this Contract.

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

1.12.3 Ensure that equipment Suppliers or 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 risks.

1.12.4 Ensure Suppliers and Manufacturers pack electrical equipment and control panels to prevent scratching, access by dirt, moisture (use of desiccants) or dust/ damage to insulation, and cover equipment having exposed bearings and glands to protect from the ingress of foreign matter.

1.12.5 Ensure Suppliers and Manufacturers give notice to the Contractor (with a copy to the Engineer) ten (10) days before delivery to allow arrangements for receipt and inspection. Arrange for delivery during normal working hours.

1.12.6 Make available suitable storage facilities and obtain agreement from the Suppliers upon a delivery date within the time frame stated in these documents.

1.13 Storage, Handling and Protection of Products

1.13.1 Handle and store products whether provided by the Supplier or supplied by Others, in a manner to prevent damage, contamination, deterioration or soiling and in accordance with the manufacturers recommendations where applicable. Obtain instruction from the Suppliers or Manufacturers, in writing, regarding 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.

1.13.2 Be responsible for the “off-loading” and storage of the equipment at the job site.

1.13.3 Store equipment suitable for outside storage to the satisfaction of the Supplier or Manufacturer and the Engineer. Identify each component with durable labels or tags securely attached to each piece of equipment, crate or container.

1.13.4 Store packaged or bundled products in original and undamaged condition with manufacturers seals and labels intact. Do NOT remove from packaging or bundling until required, in the Work.

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

1.13.6 Be responsible to arrange for heated and covered storage at the job site, as required by Suppliers or Manufacturers for sensitive items, devices or equipment.

1.13.7 Where the equipment is to be stored on site for longer than one week, determine the specific storage requirements from the Supplier or Manufacturer to ensure there is no uneven wear, distortion or other damage of equipment component parts. Provide any special packaging and protective materials, lubricants, etc. which the Suppliers or Manufacturers consider necessary to protect the equipment during the extended storage, and prior to equipment installation and performance testing. The Contractor will be responsible for removing any protective materials prior to installation and equipment performance testing in accordance with the Suppliers or Manufacturers written instructions.

1.13.8 The Contractor shall remove and replace damaged products at their own expense, NOT at the expense of the contract.

2 PRODUCTS

2.1 Work Included

2.1.1 Work shall be in accordance with the drawings and specifications and shall include all materials, labour, tools, and equipment required for the construction, including the supply, installation, testing, commissioning, and placing into operation the complete electrical system and control.

2.1.2 The Contract shall include the supply, installation, testing, and commissioning of the following, as specified and detailed in the contract documents:

.1 Required infrastructure; cable tray systems, support systems including seismic restraints, grounding system, power, and control.

.2 Ducts, conduits, trays, wires, cables and connections between the various process and mechanical equipment, and the electrical equipment;

.3 Motor Control Centre modifications including new sections including wire ways, breakers, motor starters, variable frequency drives (VFD), feeder breakers, distribution transformers, panel boards including circuit breakers, and interconnections;

.4 Variable Frequency Drives complete with circuit protection and fault protection, HOA switches and interconnections;

.5 Wiring and connections to Control System Panels complete with, power supplies, UPS, communication devices, and miscellaneous devices and instrumentation;

.6 Power, conduit, cable and interconnection of Process Mechanical and HVAC Mechanical, as specified and detailed in the contract documents. Direct coordination with Divisions 33 and 41 is required;

.7 Responsibilities to include receiving, uncrating, examining for shortages or damage, assembling, field fitting, installing, mounting, wiring and testing of all equipment;

.8 Connect and terminate single phase and/ or fractional HP motor and controls;

.9 Power and control cables, trays and conduits, buried ducts and connections between the various electrical devices and equipment rooms;

.10 General lighting, emergency lighting, fixtures, switches, and lighting control;

.11 General power, distribution transformers, panelboards, receptacles, raceways, wall boxes, pull boxes, wall plates, etc. as specified and detailed in the contract documents;

.12 Pump motor power and control connections and associated wiring;

2.1.3 All field testing, commissioning, and adjustments are to be recorded on appropriate test forms and include certified manufacturers acceptance reports.

2.2 Workmanship

2.2.1 Workmanship shall be the best quality, executed by persons qualified to do electrical work, as defined under the Electrical Safety Act.

2.2.2 The Engineer reserves the right to require the dismissal from the site of persons deemed incompetent and a threat to the safety of others.

2.2.3 In cases of dispute, decisions as to the quality, fitness or workmanship rest solely with the Engineer, whose decision shall be final.

2.2.4 If any of the specified work is such, as to make it impractical to produce required results, immediately notify the Engineer.

2.2.5 All exposed parts of the electrical wiring systems such as exposed conduits, flush plates, cabinet trim, fixtures, etc., shall be square, aligned and true with the building construction.

2.3 Equipment Manufacturers

2.3.1 All equipment shall be manufactured by experienced manufacturers who can demonstrate in-use records for all equipment offered.

2.3.2 Requests for approval of alternative suppliers shall be submitted to the Engineer. Refer to Section 01 32 19 – Submittals.

2.3.3 All equipment, whenever possible, shall be supplied by a single manufacturer, particularly where aesthetics and long-term maintenance are of concern, such as panels and instrumentation.

2.3.4 All control panels shall be CSA inspected and certified.

2.4 Alternative Equipment

2.4.1 The Contractor is required to base their quotation on the specified equipment and show a separate price increase or reduction complete with detailed descriptions for any alternative equipment.

2.4.2 The Owner / Engineer shall review alternate equipment after quotation submissions, and be the sole judge of the acceptability of alternatives. Alternate proposals shall include comprehensive details, reasoning, and any perceived benefits to the Owner.

2.4.3 After the award of the Contract, any request for a substitution must be made in writing by the Contractor (not material Supplier or Subcontractor). Such request shall state the name of the product specified, the name of the product proposed for substitution, the reason for requesting the substitution, and any change in Contract Amount, resulting from the substitution. No such substitution shall be made until an appropriate Contract Modification has been reviewed, issued and approved.

2.5 Guarantee/ Warranty

2.5.1 The Contractor shall guarantee/ warranty all equipment that they provide and shall replace at their expense, any component or part which may fail or prove defective within a period of twelve months, after substantial completion.

2.5.2 Lamps are the only exception to this guarantee/ warranty period.

2.6 Voltage Ratings

2.6.1 Operating voltages: to CAN3-C235.

2.7 Materials and Equipment

2.7.1 Provide materials and equipment in accordance with this Division and other related Divisions.

2.7.2 Equipment and materials to be CSA certified or have equivalent electrical certification, as accepted in the Province of British Columbia.

2.7.3 Where there is no alternative to supplying equipment, which is not certified, as specified, obtain special approval from the local Jurisdiction Having Authority.

2.8 Painting and Finishes

2.8.1 Thoroughly clean and degrease metal surfaces before priming and painting with two (2) air-dried coats of finish paint to provide an average thickness of 5 mils.

2.8.2 Paint indoor MCC Sections and Control Panel enclosures ASA Gray 61.

2.8.3 Where touch-up or repainting is required, use only paint obtained from the equipment manufacturer.

2.8.4 Comply with requirements of Division 09 – Finishes.

2.9 Motors

2.9.1 See section 40 05 93 – Common Motor Requirements, for additional reference.

2.9.2 All pump motors, regardless of control method used, shall be rated for inverter duty, suitable for use with a VFD.

2.10 Protective Devices

2.10.1 The Contractor shall ensure circuit protective devices such as circuit breakers, overload relays and fuses are installed and set to the required values, as determined in the coordination study. Refer to Section 26 05 73 – Overcurrent Protective Device Coordination Study.

3 EXECUTION

3.1 Installation

3.1.1 Install all equipment in accordance with the manufacturer's recommendations and in a manner that will ensure satisfactory operation & safety upon completion.

3.1.2 Provide all labour and all necessary equipment including timbers, scaffolding, tools and rigging materials for installation of the equipment.

3.1.3 The installation of certain mechanical items specified to be supplied in this section, may or may not be specified to be installed in Division 33 – Utilities. The Contractor shall coordinate this activity and include the work.

3.2 Clean-Up

3.2.1 Special care must be taken for protection of panels, switches, starters, etc. All must be substantially completed. Damage from rust, paint, scratches, etc., shall be corrected as directed by the Engineer.

3.2.2 Clean all motor controls, etc., and take special care to remove dirt, mortar, wire scraps, etc., from junction boxes and switchgear interiors.

3.2.3 Clean light fixtures and lamps thoroughly, just prior to final inspection. Fixture globes, enclosures, shielding, etc., shall be cleaned by an approved method.

3.2.4 Accessible elements of disconnecting and protective devices of equipment, coils of dry type transformers and the like shall be cleaned

with compressed air (less than 15 PSI or 103 kPa) and the enclosures vacuum completely cleaned of debris, prior to being energized.

3.2.5 Protection of electrical equipment during painting of the building shall be the responsibility of the General Contractor. This shall not relieve the Contractor of the responsibility for checking to assure that adequate protection is being provided.

3.2.6 In addition to final cleaning in accordance with Section 01 77 00 – Closeout Procedures, clean interiors, and surfaces of all debris, for all of the electrical equipment and from the general work area. Failure to perform this work will result in a listed deficiency during the reviews of the work, NO exceptions.

3.3 Contractor's Responsibility

3.3.1 The Contractor shall be responsible for the equipment and work until its completion and final acceptance.

3.3.2 The Contractor shall replace any item, which may be damaged, lost or stolen, and without additional cost to the contract.

3.3.3 Install all work promptly and in advance of concrete pouring or similar construction.

3.3.4 Coordinate with other Divisions the placement of under and in-slab conduits and sleeves prior to pouring or coring of concrete.

3.3.5 Coordinate work with other Divisions such that all equipment, conduits and wiring will be installed in the best workable arrangement.

3.3.6 Coordinate with the Utility provider, all requirements for the electrical service.

3.3.7 Protect finished and unfinished work from damage. Any equipment or material damaged by weather, mishandling or other incident, shall be replaced with new equipment and material at the direction of the Owner / Engineer, and without additional cost to the contract.

3.3.8 Before acceptance, clean all exposed surfaces of lighting luminaries, lamps, starters, Motor Control Centres, Panel boards, Control Panels and any other electrical equipment of dust, plaster, etc. Restore any damaged paint surfaces to a factory-quality finish.

3.3.9 Lighting luminaires lenses shall be cleaned, washed and dried before final commissioning.

3.3.10 Furnish all work and materials in accordance with CSA codes, Provincial and Local Inspection Department, and the Capital Regional District (CRD) regulation requirements.

3.4 Location of Equipment

3.4.1 Examine and study the Structural, Process and Mechanical drawings for items affecting the installation of the work under this specification and locate conduit runs, pull and junction boxes, disconnects, controlled equipment and panels accordingly, and such that working clearances,

minimum code clearances and maximum ceiling heights can be maintained, and to avoid conflict with other installations.

3.4.2 Any device, panel or equipment which is mis located as a result of failure to coordinate the work or observe the foregoing instructions, shall be relocated or replaced without additional cost to the contract.

3.4.3 If a specific equipment location is in question, request direction through the General Contractor, other Divisions, and from the Engineer.

3.5 Alignment of Electrical Components

3.5.1 Where there are two (2) or more equipment items (switches, outlets, panels or related equipment) are installed together, they shall be aligned vertically and/ or horizontally to present a neat orderly appearance.

3.5.2 They shall also be aligned and symmetrical with building and/ or structural elements.

3.6 Accessibility

3.6.1 Install all work so as to be readily accessible for adjustment, operation and maintenance.

3.6.2 Access hatches shall be installed, at no additional cost to the contract, in walls and ceilings to provide accessibility to electrical equipment within these areas, as required by code.

3.6.3 Locations of such access hatches shall be of an approved type and shall be installed in a pre-approved location. Coordinate as required.

3.7 Equipment Identification

3.7.1 All electrical equipment furnished by the Contractor shall be provided with identification indicating its use or function. Equipment to be identified shall include, but not be limited to panel boards, distribution panels, special system control panels, motors, and motor starters, push button stations, pilot light, special lighting or control switches, emergency receptacles, special receptacles, communication system pull boxes and junction boxes, and empty conduits provided for future use. Normal use lighting switches, receptacles and conduit will not require identification unless specifically noted otherwise.

3.7.2 Identification labels shall be white laminated plastic plates with black engraved letters. Letters shall be a minimum of one quarter inch high and centered on the plates. Attach plates with self-tapping screws or pop rivets. Labels for the emergency distribution equipment shall be red laminated plastic plates with white letters.

3.7.3 For communication systems pull or junction boxes and blank outlet boxes, plastic laminated engraved, adhesive backed labels, black color, shall be used for identification (attach to inside of cover plate in finished areas).

3.7.4 Distribution sections, motor control center, etc., shall have individually identified breakers or switches with identification directly adjacent to the device and not in a typed directory.

3.7.5 Panel boards shall be provided with a neatly typed directory with plastic protector of circuits describing loads and areas served. Room names or the Owner's room numbers shall be used; do NOT use drawing room numbers. Spare positions shall be left blank on the directory.

3.7.6 Hand lettering of identification will not be acceptable. Temporary labels used during construction shall be completely removed and surface repainted, if required.

3.7.7 Devices using standard wall plates and requiring identification shall be provided with engraved plates. Plates shall be machine engraved and the letters filled in with white enamel, with minimum 6 mm high letters.

3.7.8 Identify electrical equipment with name plates and labels as follows:

.1 Nameplates;

.2 Lamicoid three (3) mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws unless noted otherwise;

.3 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
Size 7	25 x 100 mm	2 line	6 mm high letters

3.7.9 Wording on nameplates to be approved by the Engineer prior to manufacture;

3.7.10 Allow for average of twenty-five letters per nameplate;

3.7.11 Identification to be English (British);

3.7.12 Disconnects and contactors: indicate equipment being controlled and voltage;

3.7.13 Terminal cabinets and pull boxes, indicate system and voltage;

3.7.14 Transformers, indicate capacity, primary and secondary voltages.

3.8 Field Quality Control

3.8.1 The Contractor shall conduct and pay for following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Instrumentation testing, loop testing, testing of the local control panel, radio system, functionality of the control system, and interconnectivity with the CRD SCADA system.

3.8.2 Provide manufacturer's certificate confirming that the entire installation, as it pertains to each system had been installed in accordance with the manufacturer's instructions. Refer to requirements of Division 01 – General Requirements.

3.8.3 Insulation Resistance Testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

3.8.4 Carry out all tests in presence of the Owner / Engineer, at their discretion; tests which are not conducted in the presence of the Owner / Engineer may need to be repeated, at the Contractor's expense, unless the Engineer provides written confirmation that their presence is not required.

3.8.5 Provide instruments, meters, equipment and personnel required to conduct the tests.

3.8.6 Ground fault detectors shall be dynamically tested by injecting current flow into the zero sequence current sensor.

3.8.7 Submit all test results for the Engineers review. Include all test results in the Operations and Maintenance manuals, that are to be submitted at the completion of the project.

3.9 Construction Period Tests

3.9.1 All work which is required to be placed within the construction or concealed shall be carefully tested and inspected before being permanently covered up.

3.9.2 All tests shall be made in the presence of the Owner / Engineer, and shall meet with their approval.

3.10 Start-Up, Testing and Commissioning

3.10.1 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.

3.10.2 Results of tests are to be logged by the Contractor and submitted to the Engineer. Any apparent defects shall be reported and corrected.

3.10.3 When preliminary checks have been completed and equipment is operating or ready to operate, individual systems shall be setup in accordance with the specifications and/ or manufacturer's recommendations. After setup, the system shall be placed in operation in

conjunction with the Owner, their designated operating personnel and the Engineer.

3.10.4 In general, testing, start-up and commissioning shall be in accordance with Sections 01 91 13 - General Commissioning Requirements, 26 79 50 - Controls and Instrumentation System Commissioning and Start up, and 26 79 00 - Acceptance Testing.

3.11 Substantial Completion Inspection

3.11.1 Prior to Substantial Completion inspection, submit written confirmation that:

.1 The installation, as specified is completely assembled and wired;

.2 All wiring devices, plates, motor control, lighting fixtures, standby generator, and other equipment are operational, clean and correctly labeled;

.3 All systems have been tested as required and are in proper working order;

.4 Panel board directories have been completed and all lamacoid nameplates have been installed;

.5 Factory finished equipment has been cleaned, touched- up or refinished to present a new appearance;

.6 Starter parameters have been set up and tested, and harmonics and power quality levels meet specification requirements;

.7 Protection relays and/ or instrumentation (circuit breakers, overload relays, ground fault detectors, metering equipment) have been set-up and tested;

.8 Where applicable, Communication Networks, Device Level Busses, have been set-up, addressed, tested and are fully functional;

.9 Record Drawings and Operating and Maintenance Manuals have been submitted for draft review.

3.12 Care, Operation and Start-Up

3.12.1 Instruct the Owner / Engineer in the operation, care and maintenance of equipment in accordance with Division 01 – General Requirements and Section 26 99 20 – Electrical and Instrumentation System Personnel Training, of these specifications.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GNERAL

1.1 Work Included

1.1.1 Provide a complete system of wiring, making all connections necessary for the installation shown on drawings.

1.2 References, Codes and Standards

1.2.1 CSA C22.2 No. 0.3 , Test Methods for Electrical Wires and Cables.

1.2.2 Install and rate power cables in accordance with the Canadian Electrical Code requirements, or in accordance with ICEA requirements where permissible.

1.3 Product Data

1.3.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

2 PRODUCTS

2.1 Device and Power Wires

2.1.1 Conductors: stranded for 12 AWG and larger. Minimum size: 12 AWG.

2.1.2 Copper conductors: size as indicated, with minimum 600V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

2.1.3 Copper conductors for 24VDC: size as indicated, with thermoplastic insulation type TWH rated at 300 V.

2.2 Teck Cable

2.2.1 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

2.2.2 Insulation:

.1 Type: ethylene / propylene.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

2.2.3 Fittings

.1 Fittings shall be rated for outdoor corrosive atmospheres.

.2 Fitting installed in hazardous locations shall be rated HL and be clearly marked as such.

2.2.4 Inner jacket: polyvinyl chloride material.

2.2.5 Armour: interlocking galvanized steel.

2.2.6 Overall covering: thermoplastic polyvinyl chloride material.

2.2.7 Fastenings:

.1 One hole zinc straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Six mm dia. threaded rods to support suspended channels.

2.2.8 Connectors:

.1 Watertight or explosion-proof approved for TECK cable to suit installation location.

2.3 Control Cables

2.3.1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW / TWH polyethylene insulation. Analog signal cable to be complete with shielding of tape coated with paramagnetic material or tape coated with diamagnetic material and drain wire over each pair and an overall covering of polyethylene jacket, or armored jacket in match TECK cable specifications.

2.4 Non-Metallic Sheathed Cable

2.4.1 Non-metallic sheathed copper cable type: [NMD-7] [NMD-7 nylon] [NMW-9] [NMW-10], size as indicated.

3 EXECUTION

3.1 General

3.1.1 Minimum conductor size #12 AWG except for luminaire drops which can be #14 AWG if fed from 15A circuits.

3.1.2 Do not XLPE and TWH.

3.2 Installation of Device and Power Wires

3.2.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 260534.

.2 In cabletroughs in accordance with Section XX.

3.3 Installation of Teck Cable 0 - 1000 V

3.3.1 Install cables.

3.3.2 Group cables wherever possible on channels.

3.3.3 Lay cable in cabletroughs and cable trays in accordance with CEC requirements.

3.3.4 Terminate cables in accordance with Section 260522 - Connectors And Terminations 0 - 1000 V.

3.4 Installation of Control Cables and Conductors

3.4.1 Install control cables or conductors in conduit.

3.4.2 Control cables may be installed in cable troughs within control system cabinets.

3.4.3 Ground control cable shield at the Main LCP location only.

3.5 Installation of Non-Metallic Sheathed Cable

3.5.1 Install cables.

3.5.2 Install straps and box connectors to cables as required.

3.6 Workmanship

3.6.1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

3.6.2 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.

3.6.3 Do not install any conductor smaller than #12 AWG, except where specifically indicated otherwise, i.e. for control systems wiring, etc.

3.6.4 Provide sizes of conductors as shown on drawings. Voltage drop from panels to farthest device must not exceed 2% at full load in any case. Advise Consultant if problem is foreseen.

3.6.5 Exercise care in stripping insulation from wire. Do not nick conductors.

3.7 Identification, Coding and Balancing

3.7.1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 260000 - Electrical General Requirements.

3.7.2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.

3.7.3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.

3.7.4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

3.8 Testing

3.8.1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by the cable manufacturer.

3.8.2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Consultant.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Product Data

1.1.1 Submit product data sheets in accordance with Section 260000 - Electrical General Requirements.

2 PRODUCTS

2.1 Connectors and Terminations

2.1.1 Copper long barrel or short barrel compression connectors as required and sized for conductors.

2.1.2 Use 2 or 3 way joint boxes approved for wet locations in all locations other that the electrical room. Box type to Section 260534

3 EXECUTION

3.1 Installation

3.1.1 Install terminations, in accordance with manufacturer's instructions

3.1.2 Install splices only with the prior approval of the engineer. Splices to be within weatherproof enclosures or potting compound and in accordance with manufacturer's instructions.

3.1.3 Bond and ground as required.

3.1.4 All connection and/or terminations to be compete with proper identification colours and tagging.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Related Work

1.1.1 Refer to Section 26 00 00 – General Electrical Requirements.

1.2 SUMMARY

1.2.1 Install complete additions and/or modifications to the grounding system as indicated and in accordance with Canadian Electrical Code and local inspection authority, the Authority Having Jurisdiction.

1.2.2 Extend existing grounding system as indicated on drawings and in accordance with Canadian Electrical Code and local inspection authority, the Authority Having Jurisdiction.

2 PRODUCTS

2.1 Equipment

2.1.1 Conductors: Bare, stranded, soft annealed copper wire, minimum size No. 2/0 AWG for ground grid, electrode interconnections, metal structures, transformers, equipment, and ground connections of metal parts, including cable trays.

2.1.2 Clamps for grounding of conductor to electrically conductive underground water piping.

2.1.3 Rod electrodes, copper clad steel, 19 mm diameter by 3 m long; or, a plate electrode in direct contact with exterior soil at not less than 600mm below grade level.

2.1.4 Ground electrode inspection boxes: for non-traffic areas, Slacan cat. #22109 or approved equal. For traffic areas provide a concrete ground inspection box with traffic rated cover.

2.1.5 System and circuit, equipment, grounding conductors, bare stranded copper, soft-annealed, size where indicated or required by code.

2.1.6 Thermally welded connections will NOT be permitted.

2.1.7 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings;

.2 Protective type clamps;

.3 Bolted type conductor connectors;

.4 Compression type conductor connectors;

.5 Compression type wire connectors;

.6 Bonding jumpers, straps.

3 EXECUTION

3.1 Installation General

3.1.1 Where metallic conduit is used, provide a ground wire inside the conduit.

3.1.2 Install connectors in accordance with the manufacturer's instruction.

3.1.3 Protect exposed grounding conductors from mechanical injury.

3.1.4 Make buried connections, and connections to conductive water main, electrodes, using copper compression connectors.

3.1.5 Use mechanical connectors for connections to equipment provided with lugs.

3.1.6 Soldered joints will NOT be permitted.

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

3.1.8 Connect building structural steel and metal siding to ground by bolting or welding copper to steel, in at least six (6) locations around the structure.

3.1.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.1.10 Install facility ground grid consisting of 3x19mmØ Cu. Ground rods, 3m long, installed with inspection wells. Connect rods with #2/0 bare Cu. ground conductor and connect to new main ground bus with #2/0 ground.

3.2 Equipment Grounding

3.2.1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list, service equipment, transformers, duct systems, frames of motors, pump frame, motor control center (MCC), starters, control panels, building steel work, distribution panels, magnetic flow transmitters, underground piping, and outdoor lighting including poles/ masts.

3.3 Grounding Bus

3.3.1 Extend ground to equipment from the main ground bus mounted inside of the electrical room.

3.3.2 Ground items of electrical equipment to the main ground bus with individual bare stranded copper connections, size No. 6 AWG, minimum.

3.4 Field Quality Control

3.4.1 Perform tests in accordance with Section 26 00 00 – General Electrical Requirements and 26 08 00 – Commissioning of Electrical Systems.

3.4.2 Perform ground continuity and resistance tests (3-point method) using method appropriate to site conditions and approval of the Consultant and the local Authority Having Jurisdiction over the installation. Ground grid resistance to be 2 ohms or less.

3.4.3 Perform tests before energizing electrical system.

3.5 Field Check List

3.5.1 Grounding conductors are adequately protected from mechanical damage and, if buried, are deep enough to meet or exceed minimum code depths.

3.5.2 Grounding conductors are mechanically and electrically secure. Grounding conductors are free of damage.

3.5.3 Compression connections will be examined to determine that they are electrically and mechanically acceptable.

3.5.4 Check that only copper conductors are used for grounding system.

3.5.5 Ensure size of grounding conductors meets applicable code standards.

3.5.6 Connections to electrodes are electrically and mechanically secure.

3.5.7 Connections to system distribution equipment is correct and secure.

3.5.8 Bonding of all metallic electrical equipment (motors, luminaires, welders, etc.) has been accomplished.

3.5.9 Bonding of all metallic raceways (conduits, cable trays, wireways, etc.).

3.5.10 Bonding of metal gas lines, water lines, sewer lines, instruments and telecom systems has been accomplished.

3.5.11 Isolated grounds have been connected to the bonding bus of the distribution system.

3.5.12 Structural steel and steel supports have been bonded.

3.5.13 The bonding screw of the identified conductor terminal (neutral) has been removed from all distribution panel boards.

3.5.14 Service neutral conductor is properly grounded.

3.5.15 Neutral conductors on the secondaries of the transformer is grounded.

3.5.16 Transformer cores and cases are bonded.

3.5.17 All flexible raceways have a separate bonding conductor placed within the flexible raceway.

3.5.18 A bonding jumper is present between the metal outlet box and the receptacle. A bonding conductor is present for the receptacle.

3.5.19 Mounting straps of receptacles and switches must be bonded. Spacers used on mounting screws must not impede bonding of mounting strap.

3.5.20 Continuity of the entire grounding and bonding system.

3.5.21 Lightning arrestors are grounded to earth.

3.5.22 Alternate power supplies (UPS, etc.) are correctly grounded and/ or bonded.

3.5.23 Secondary of instrument transformers are grounded.

3.5.24 Cables supplying motors have adequately sized bonding conductors.

3.5.25 Metallic raceways placed in the ground or in concrete contain a bonding conductor.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Work Included

1.1.1 Provide a complete system of conduit and fittings for installation of wiring.

2 PRODUCTS

2.1 Rigid Steel Conduit

2.1.1 Galvanized with threaded joints and connections.

2.1.2 Connections in dry locations: steel or malleable iron locknuts inside and outside enclosures. Insulated bushings Thomas & Betts Series 222 or approved alternate.

2.1.3 Connectors subjected to moisture interior and exterior: liquid and dust tight with insulated throat, Thomas & Betts "Bullet Hub" 370 Series or approved alternate.

2.1.4 Fittings: cast metal "Condulet" as manufactured by Crouse Hinds Canada Ltd. including gasketted covers in damp locations.

2.1.5 Expansion joints: cast metal Crouse-Hinds type XJ or approved alternate.

2.2 E.M.T. Conduit

2.2.1 Fittings in dry locations (within the electrical room only): Steel or zinc set screw connectors with insulated throat. Steel or zinc set screw couplings.

2.3 Liquid Tight Flexible Conduit

2.3.1 Connections at mechanical equipment, instruments, motors, or other field devices. To transition from ridged conduit to flexible at no more than on meter from the connection point to provide a service removeable connection method.

2.3.2 Conduit: flexible metal conduit with liquid tight PVC jacket. Industrial Wire & Cable "Liquiseal".

2.3.3 Connectors: captive sealing jacket and ground cone insulated throat, steel (Thomas & Betts Ltd. "Super Tight", Series 6000).

2.4 Zinc Fittings

2.4.1 Connectors and couplings to be manufactured of No. 3A alloy conforming to ASTM designation B.240 as manufactured by Regal Manufacturing.

3 EXECUTION

3.1 Rigid Steel Conduit

3.1.1 Use as raceways for following applications:

.1 In all areas exposed to weather.

.2 Locations where mechanical damage may occur and in mechanical rooms to a height of 1 metre.

.3 Three phase motor wiring (Teck cable may also be used for this application where shown on the drawings).

3.2 E.M.T. Conduit

3.2.1 Use as raceways for following applications:

.1 In surface and concealed areas or in poured concrete above ground level.

.2 Electrical room only

3.3 Liquid Tight Flexible Conduit

3.3.1 Use as raceways for following applications:

.1 At all motors, pipe mounted control devices, and other devices subject to movement or water.

3.3.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus 4 times the conduit diameter.

3.3.3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.4 Corrosion Control (Special Application)

3.4.1 In wet locations as pool and pool mechanical rooms and pool service tunnel fittings, outlet boxes, junction boxes, rack members, clamps and fasteners shall be zinc or cadmium plated. All threads shall be completely coated.

3.4.2 In the pool and basement areas all exposed conduit, couplings and straps shall be corrosion resistant epoxy-polyester coated Columbex Green Guard II or equivalent.

3.4.3 Use a different colour of coating for control, power and lighting.

3.5 Workmanship

3.5.1 Install all conduit and wiring concealed, unless otherwise shown on the drawings. Do not recess conduit in columns, except as noted, without permission.

3.5.2 Where conduit is run exposed, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on Unistrut racks.

3.5.3 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

3.5.4 Slabs on grade: Install rigid PVC conduit in the gravel base below concrete slabs. Provide mechanical protection around stub-ups through slab and extend 150 mm beyond concrete. When rigid steel conduit is installed in contact with earth it shall be protected by Polykin #940 tape. Extend taping 300 mm above finished grade.

3.5.5 Metal conduit installations in concrete pours: Tie down conduit to prevent shifting. All joints are to be made up tight to ensure ground continuity. To prevent concrete entry, seal EMT set screw fittings with tape, pack outlet boxes and cap conduit terminations both in boxes and stub-ups. Apply Polykin #940 tape to the conduit 152 mm both sides of the point of leaving slab.

3.5.6 Do not place conduit in concrete slabs in which slab thickness is less than four times conduit diameter. Place conduits larger than this size under floor. Conduits to have minimum 25 mm concrete cover.

3.5.7 Organize conduit in slabs to minimize crossovers. Obtain approval and minimum concrete cover required from structural engineer prior to installing conduits in slabs.

3.5.8 At all recessed panels cap 2 25 mm and 4 - 19 mm empty conduits from panel into ceiling above and below for future use.

3.5.9 Provide Brady underground warning tapes 300 mm below grade above all underground conduits. Tape shall be yellow warning tape, 150 mm wide.

3.5.10 Where conduits or ducts enter or exit concrete structures below grade provide 16 mm x 1500 mm steel reinforcing dowels to prevent shearing. Extend dowel 1000 mm beyond concrete and band conduit to dowel. The first 3 meter length of conduit extending from the structure to be Polykin wrapped rigid steel.

3.5.11 Where conduit is installed in floor slabs to run up at equipment or motors, carefully check all conduit locations. Verify conduit locations for mechanical equipment from shop drawings or detail drawings. Brace all stub-ups. Stub-ups shall be rigid steel.

3.5.12 Where steel conduit is required to be bent, do not heat, and do not bend conduit in such a way as to reduce pipe cross section area at any point. Radii of bends shall be as per Canadian Electrical Code.

3.5.13 For all runs of conduits, do not include more than equivalent of 4 quarter bends. Provide conduit fittings, pullboxes and junction boxes where necessary. Pulling elbows shall not be used except by special permission.

3.5.14 Where possible, install conduits so that they are not trapped, cap turned up conduits to prevent the entrance of dirt of moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

3.5.15 Take extreme care in reaming ends of all conduit to ensure a smooth interior finish that will not damage the insulation of the wires.

3.5.16 Use insulated non-metallic bushings on all conduit terminations.

3.5.17 Ensure electrical continuity in all conduit systems.

3.5.18 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

3.5.19 Install a 90 lb. test line in all conduits left empty by this contractor including those which others will pull cables, wires, etc.

3.5.20 Conduits and ducts crossing building expansion joints shall have conduit expansion fittings to suit the type of conduit used, and shall be Crouse-Hinds, Sceptre, or approved fitting.

3.5.21 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant or approved equal.

3.5.22 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on the drawings are installed, wall openings shall be closed with material compatible with the wall construction. Review size and quantity of conduit sleeves with the Consultant.

3.5.23 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.

3.5.24 Where conduit finish is damaged, repair or replace.

3.5.25 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of boxes where support is not provided.

3.5.26 All branch circuit wiring, home-runs, communication and data to be minimum 20 mm diameter unless otherwise stated.

3.5.27 Provide necessary flashing and pitch pockets, making watertight joints where conduits pass through roof or watertight membranes.

3.5.28 Where panelboard branch circuit conduits are amalgamated, size shall not exceed 25 mm diameter.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1.1 Related Work

1.2 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other parts of the contract documents.

1.3 Regulatory Requirements

1.3.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

1.3.2 The Contractor shall retain the services of a Seismic Consulting Engineer, who shall be able to provide a proof of professional insurance and the related practice credentials, when requested by the Engineer. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as British Columbia Building Code (BCBC) requirements.

1.3.3 The Contractor's Seismic Consulting Engineer shall submit original signed BCBC 'Letters of Assurance', 'Schedules B', and 'C-B', to the Engineer.

1.3.4 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.4 Scope

1.4.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.4.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.

1.4.3 Provide restraint on all equipment and machinery, which is part of the building 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.

1.4.4 The total electrical seismic restraint design and field review and inspection will be by a British Columbia registered Professional Structural Engineer, who specializes in the restraint of building elements. Contractor to allow for coordination, provision of the seismic restraints, as well as all costs for the services of the Seismic Consulting Engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of the electrical installations.

1.4.5 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, additional costs will NOT be accepted.

1.4.6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor.

1.4.7 Provide seismic restraints on all equipment, and/ or installations, and/ or assemblies, which are suspended, pendant mounted, shelf mounted, freestanding and/ or bolted to the building structure or the support slabs.

1.4.8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall furnish copies of the Seismic Consultant's reports to the Engineer for record and verification purposes. The Contractor shall correct any deficiencies noted without additional cost to the contract.

1.4.9 Include all costs associated with the seismic installation and certification in the base tender.

1.5 Shop Drawings and Submittals

1.5.1 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.

1.5.2 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.

2 PRODUCTS

2.1 Not Used

2.1.1 Not used.

3 EXECUTION

3.1 General

3.1.1 All seismic restraints systems shall conform to local Authority Having Jurisdiction, and all applicable code requirements.

3.2 Conduits And Cable Trays

3.2.1 Provide restraint installation information and details for the equipment and materials as described below.

3.2.2 Vertical Conduit:

.1 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 two stories in height, at each floor by approved metal floor clamps.

.2 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 on center (o.c).

.3 Riser joints shall be braced or stabilized between floors.

3.2.3 Horizontal Conduits:

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

3.2.4 Provide transverse bracing for cable trays and conduit runs at 12.2 m o.c maximum unless otherwise noted. Provide bracing at all 90o bend assemblies and pull box locations.

3.2.5 Provide longitudinal bracing for cable trays and conduit runs at 24.4 m o.c. maximum unless otherwise noted.

3.2.6 Do not brace cable trays and conduit runs against each other. Use separate support and restraint system.

3.2.7 Support all cable trays and conduit runs in accordance with the capability of the selected material to resist seismic load requirements as instructed by the Seismic Consultant.

3.2.8 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.

3.2.9 A tray system (stacks) and conduit system(s) 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. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

3.2.10 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with fire-stopping where required.

3.2.11 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 the Consultants, for their reference.

3.3 Floor Mounted Equipment

3.3.1 Bolt all equipment, e.g. transformers, generators, motor control centers, 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.

3.3.2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

3.4 Light Fixtures

3.4.1 LED luminaires in suspended ceilings shall be hung independently of the ceiling system (where applicable). Fixtures shall be secured to concrete or structural deck above by at least two (2) taught cables which are connected to the fixture at diagonal points.

3.4.2 Surface and recessed style luminaires shall be hung independently of the ceiling system. Luminaires shall be secured to concrete or structural deck above by taught cables.

3.4.3 Luminaires which are hung independently of ceiling systems shall have minimum of one (1) seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.

3.4.4 Cables shall be corrosion resistant and approved for the application.

3.4.5 Luminaires which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Codes and Standards

1.1.1 Canadian Electrical Code (CEC), CSA C22.1, current adopted edition.

1.1.2 CSA 22.2 – No. 0.3, Test Methods for Electrical Wires and Cables.

1.1.3 ANSI/ NETA, ATS.

1.2 Description

1.2.1 References to completion of the work in other sections requires that full function testing and operational demonstration be performed for each system included in the work of the Contractor. Testing and start-up for each system by Division 26 – Electrical, to include the following activities:

.1 Pre-start-up visual inspection and testing;

.2 Start-up for energization and full functional demonstration;

.3 Post start-up tests and operational checks;

.4 All corrective and follow-up actions and any retesting, as necessary.

1.2.2 Test and check all portions of the electrical system for satisfactory operation. All tests to be done in the presence of the Consultant and/ or his representative, suitably logged, tabulated, signed, and incorporated in project documentation.

1.2.3 Testing and verification to include, but not be limited to the following:

Test	**Performance by**
Normal visual and mechanical inspections	Electrical trade and low-tension systems installers
Megger tests	Electrical trade
Load balance tests	Electrical trade
Motor current recordings	Electrical trade with Divisions 33 and 41
Distribution voltage checks	Electrical trade
Distribution Equipment Tests	Manufacturer’s representative & Electrical trade
Power quality readings	Electrical trade
Witness testing	Engineer, Electrical trade
Low voltage systems	Low voltage systems installation and electrical trade representative

1.2.4 Pre-start up checks and function tests for major electrical distribution equipment to be provided by authorized Manufacturer's service

representative. Division 26 – Electrical, to include all costs for involvement of manufacturer's representatives for this work.

1.2.5 Provide records of all production tests required by CSA for all power distribution equipment to Engineer prior to field testing with applicable copies of factory tests issued to the independent testing firm for comparative results.

1.2.6 Any manufacturer, supplier or Contractor who objects to test procedures, methods and test voltage levels specified herein to confirm objections in writing at least ten (10) working days prior to request for quotation closing stating all reasons for such objections. Failing to do this constitutes acceptance of all test procedures stated herein and ensures that warranties are not voided by such tests and procedures.

2 PRODUCTS

2.1 Not Used

2.1.1 Not used.

3 EXECUTION

3.1 Distribution System

3.1.1 Before energizing any portion of the electrical systems, perform insulation resistance (Megger) tests on all feeders. Results are to conform to the manufacturer’s recommendations, NETA-ATS recommendations, and to the satisfaction of the Authority Having Jurisdiction and the Consultant. Test results to be logged, tabulated, and incorporated into operating and maintenance manuals.

3.1.2 Upon completion of equipment installation and immediately prior to final inspection and take-over check the load balance on all feeders at motor control center and panel boards. Tests to be carried out by turning on all possible loads in the building and checking load current balance. If load unbalance exceeds fifteen percent (15%), reconnect circuits to balance load.

3.1.3 Upon facility completion and immediately prior to final inspection and hand-over to Owner, in conjunction with other divisions, monitor and record all motor operating amperages under full load conditions.

3.1.4 Make voltage checks throughout the building after the building is in operation for sixty (60) days and at this time, if directed by the Consultant, make necessary adjustments to ensure utilization voltages are within prescribed limits. Readings taken at this time to be logged, tabulated and any adjustments made to be suitably logged and incorporated in the Operating and Maintenance manuals.

3.1.5 Allow for certified power factor readings in base quotation amount. Readings to be taken after the new construction is fully occupied and operational. Duration of the test to be a minimum of three (3) x 24 hours.

3.1.6 All protective devices to be tested and calibrated or calibration tested, as applicable, on site prior to energizing, to ensure proper operation as calculated on co-ordination studies. Testing and calibration to consist of verification of published curves and setting of devices at specified settings. Complete report to be submitted to the Consultant within seven (7) days of completion of testing.

3.1.7 In co-operation with Division 33 – Utilities, take clip-on ammeter readings on all phases of all mechanical and packaged process equipment motors with motors running under full load condition. Readings to be logged, tabulated, and incorporated in the operating and maintenance manuals.

3.1.8 All the following tests to be performed by Division 26 – Electrical, to low voltage (600 Volt and below) switchboards and motor control (suitably log test results in O & M manuals):

.1 Phase continuity, identification test of bussing per latest provided as-built Manufacturer's drawings;

.2 Mechanical torque test of all bus and cable terminations to recommended Manufacturer's levels;

.3 Insulation resistance test - all phases to others and ground, using appropriate DC test level for voltage level of equipment;

.4 Contact resistance test: using a 100 Ampere, contact resistance tester;

.5 Testing of all breaker units per the manufacturer's installation and maintenance instructions, provided including full mechanical-electrical operation inspection and test;

.6 Metering: calibration function test all meters installed. (Revenue metering excluded).

3.2 Witness Testing

3.2.1 Allow in base quotation amount for Manufacturer’s technician set-up and witness testing of the following equipment:

.1 Motor Control Centre (MCC), including incoming main breaker, metering, surge protection device, automatic transfer switch, and Variable Frequency Drives (VFD);

.2 Outdoor Standby Diesel Generator;

.3 Instrumentation;

.4 RTU/ Local Control Panel, including functionality.

3.2.2 Include all costs of Division 26 – Electrical, manufacturers and suppliers associated with this testing.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 INTENT

1.1.1 This section specifies general requirements common to all starting and testing of electrical components and systems. Review this section in conjunction with related sections, which specify specific portions of the electrical starting and testing of the work.

1.1.2 Except where otherwise specified, arrange and pay for the testing and related requirements specified herein, and all other related sections.

1.1.3 If test results do not conform with the applicable requirements, repair, replace, adjust or balance components and systems. Repeat testing as necessary until results acceptable to the Consultant are achieved.

1.2 RELATED WORK

1.2.1 Refer to the electrical component and systems specified in Division 26 – Electrical.

1.3 DOCUMENTATION

1.3.1 Manufacturer's Reports:

.1 Arrange for manufacturer to submit copies of all production test records required by these specifications prior to shipping any equipment;

.2 Arrange for manufacturer to submit a brief step-by-step description of entire starting procedure to allow the Consultant to repeat starting, at any given time.

1.3.2 Confirm delivered equipment complies with the approved shop drawings.

1.3.3 Provide complete copies of testing reports for all distribution equipment. Report forms to be accepted industry documentation as provided by testing firms regularly engaged in distribution equipment testing.

1.4 STARTING AND TESTING

1.4.1 Prior to testing ensure all electrical components are cleaned and free of dust.

1.4.2 After testing, protect components subject to dust from construction activities.

1.4.3 Notify the Owner / Engineer, when starting and testing of all components has been completed.

1.4.4 Do not conceal or cover components until inspected, tested and reviewed by the Consultant.

1.4.5 Assume all liabilities associated with starting, testing and balancing procedures.

1.4.6 Assume all cost associated with starting, testing, adjusting and balancing including the supply of testing equipment.

1.5 WITNESSING OF STARTING AND TESTING

1.5.1 Prior to starting and testing of electrical equipment or systems, prepare a schedule for the required testing. Review the schedule with the Consultant.

1.5.2 Provide sufficient notice (minimum 10 days) prior to commencing tests.

1.5.3 The Consultant may choose witness all or any portion of testing and starting procedures performed by Division 26 - Electrical. Contractor to ensure adequate notification has been given.

1.5.4 The Division 26 – Electrical Contractor shall be present for all the required equipment tests.

1.6 QUALITY ASSURANCE

1.6.1 All starting, testing procedure shall be in accordance with:

.1 These contract documents;

.2 Requirements of authorities having jurisdiction;

.3 Manufacturer's published instructions;

.4 Applicable CSA, IEEE, IPCEA, NEMA and ASTM Standards.

1.6.2 Personnel involved in starting, testing, adjusting and balancing procedures shall have experience in electrical components and systems starting and testing and shall be able to interpret results of readings and tests and report state of systems in a clear and concise manner.

1.6.3 If requirements of any of the foregoing conflict, notify the Consultant before proceeding with tests and obtain written clarification.

1.7 MANUFACTURER’S STARTING RECOMMENDATIONS

1.7.1 Prior to starting components or systems, obtain and review manufacturer's installation, operation and starting instructions.

1.7.2 Use manufacturer's and supplier's starting personnel where required to maintain validity of manufacturer's warranty. Confirm with manufacturer that all testing specified in these specifications will not void any warranties.

1.7.3 Compare installation to the manufacturer's published data and record discrepancies. Modify procedures detrimental to component performance prior to starting component.

1.8 MANUFACTURER’S SERVICE ONSITE

1.8.1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of the following electrical components and systems:

.1 Power Distribution System (distribution equipment, MCC, etc.);

.2 Motor Controls and Automation Products; and

.3 Outdoor Enclosed Stand-by Diesel Generator.

1.8.2 Manufacturer's personnel shall be experienced in the design and operation of components and systems being started, have the ability to

interpret results of readings and tests and report results in a logical, orderly fashion.

1.9 PRESIDING AUTHORITIES

1.9.1 Starting procedures defined in this section may duplicate verification conducted by presiding authorities. To facilitate expedient turnover of building, arrange for authorities to witness procedures in a manner that avoids unnecessary duplication of tests.

1.9.2 Obtain certificates of approval, acceptance and comply with rules and regulation of Authorities Having Jurisdiction. Provide copies of all certificates to the Consultant and include in the O&M manuals to be submitted at the completion of the project.

1.10 CORRECTION OF DEFICIENCIES

1.10.1 Correct all contract deficiencies found during the electrical component and system starting and testing, and the Consultants performance verification, where/ if applicable.

1.11 COMPLIANCE

1.11.1 Failure to follow the specific instructions defined herein pertaining to correct starting procedures may result in re-evaluation of component by independent testing agency selected by the Consultants, at the Contractors expense. Should results reveal component has not been started in accordance with specified requirements, component may be rejected. If rejected, remove component from site and replace. Replacement component shall also be subject to full starting procedures, using same procedures specified on the originally installed component.

1.12 COORDINATION

1.12.1 Coordinate with all sub-trades, other divisions, manufacturers, suppliers, vendors and any other specialists, as required to ensure all phases of the work are properly organized and coordinated, prior to commencement of each particular testing procedure. Establish all necessary labor/ manpower requirements.

1.12.2 Coordinate the activities of this section with the starting and testing of:

.1 The Process / Mechanical components and systems, specified in Division 33;

.2 The Instrumentation and Control components and systems, specified in Division 25 – Automation and Controls;

.3 The HVAC / Mechanical components and systems, specified in the Mechanical Contract Documents;

.4 The General Contract specified in Division 01 – General Requirements.

.5 Any other components and systems, specified in other divisions of the contract documents. INCUDING ALL OWNER SUPPLIED EQUPMENT VENDORS

1.12.3 Where any component or systems require testing prior to starting, ensure that such work has been completed and approved, prior to starting of the electrical components and systems.

1.13 IMPLEMENTATION

1.13.1 Unless otherwise specified in writing by the Consultant, all testing and related requirements specified herein, will be performed prior to the issue of the Interim Certificate of Completion (Substantial Completion).

2 PRODUCTS

2.1 NOT USED

2.1.1 Not used.

3 EXECUTION

3.1 GENERAL COMPONENT STARTING AND TESTING

3.1.1 Energizing Electrical Components:

.1 Prior to energizing components provided under other sections and components provided by the Owner:

.1 Confirm components nameplate data with characteristics of power supply;

.2 Verify supply authority voltage and phase rotation;

.3 Ensure all independent testing as specified in related sections has been completed and deficiencies have been corrected;

.4 Close and open all devices to ensure proper mechanical operation;

.5 Megger all feeders and record results on approved verification forms.

.2 Load Balancing:

.1 Measure load balance on all feeders at distribution centers, motor control centers and panel boards with normal loads (lighting included) operating at time of acceptance. Adjust branch circuit connections as required to obtain the 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 components;

.3 If load unbalance exceeds 15%, reconnect circuits to balance loads. Revise/ correct the panel board directories and wiring identification accordingly;

.4 Submit, at completion of work, a report listing phase and neutral currents on panel boards, dry core transformers and motor control centers, operating under normal loads.

State hour and date on which each load was measured and voltage at time of test.

.3 Insulation Resistance Testing (Megger Test):

.1 Megger circuits, feeders and components up to 350 V with a 500 V instrument;

.2 Megger 350-600 V circuits, feeders and components with a 1000 V instrument;

.3 Check resistance to ground before energizing;

.4 Carry out tests in presence of the Consultant;

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project;

.6 Submit test results for the Consultant's review.

.4 Ground Resistance Testing:

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

.5 Coordination of Protective Devices:

.1 Ensure circuit protective devices such as overcurrent trip relays, fuses are installed to design values and settings.

.6 Voltage Testing and Adjusting:

.1 Test voltage at service entry point, and secondary of transformers above 15 kVA. Record voltages at interim acceptance and three months after practical completion for a period of four hours during a normal work day.

.2 Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by the Consultant.

3.2 LOW VOLTAGE POWER DISTRIBUTION (<750V)

3.2.1 Low Voltage Motor Control Center :

.1 Enclosure:

.1 Visual inspection;

.2 Torque all bus connections to Manufacturers requirements and seal with red lacquer;

.3 Megger test main bus at 1000 V;

.4 Check phasing and continuity of horizontal and vertical bus. This includes phasing and phase rotation of two incoming services or supplies.

.2 Wiring checks:

.1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams and project specifications;

.2 Test each circuit for continuity using a buzzer or similar device;

.3 All current circuits shall be injected, all voltage circuits shall be powered at 120V, all devices functioned and checked against control schematic diagram;

.4 Check polarity and verify phase relationships on all three phase metering circuits;

.5 Where errors are discovered and changes are required, mark-up and note on Vendor drawings with the corrective action required. These notations will be checked upon correction of the error;

.6 Function test secondary transfer schemes (if any) by simulated loss of incoming feeders (phase loss) to ensure proper operation.

.3 Instrumentation:

.1 Test and calibrate all digital metering units in accordance with the manufacturers bulletins and this section;

.2 Check calibration on all ammeters using a 5 Ampere secondary injection test;

.3 Perform wiring checks as listed above.

.4 Breakers:

.1 Molded case breakers 50 Ampere frame and larger;

.2 Inspection and testing, per this specification section.

.5 Transformer:

.1 Inspection and testing, per this specification section.

.6 Fused or unfused disconnect switches:

.1 Visual inspection and cleaning;

.2 Ductor test across the switch blade, contact surfaces;

.3 Megger test;

.4 Mechanical function test.

3.2.2 Circuit Breakers:

.1 Breakers - Molded case breakers to 150 Ampere

.1 Visual inspection;

.2 Mechanical function test;

.3 Set all units with adjustable magnetic trip units.

.2 Breakers - Molded case breakers 150 Ampere frame and larger:

.1 Visual inspection;

.2 Ductor test;

.3 Megger test;

.4 Mechanical function test;

.5 Set all units with adjustable magnetic trip units.

.6 Where solid state protection is provided with large breakers, test units as follows:

.1 Inspect and test in accordance with manufacturer's most recent installation and maintenance information sheets;

.2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction;

.3 If the manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories;

.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of the relay circuit to test the trip operation;

.5 Check C/T and P/T ratios and compare to coordination study data.

.3 Contact resistance (ductor) test and adjust contacts;

.4 Insulation resistance (megger) test;

.5 Mechanical function test;

.6 Electrical function test;

.7 Test and calibrate, to settings provided, all elements of solid-state trip unit as described in the Protective Relaying clause.

3.2.3 Wiring & Cables:

.1 General:

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

.2 Test service grounding conductors for ground resistance;

.3 Provide the Consultant with a list of test results on approved verification form showing location at which each test was made, circuit tested and results of each test;

.4 Remove and replace the entire length of cable if cable fails to meet any of the test criteria.

3.2.4 Grounding:

.1 Perform ground continuity and resistance tests using method appropriate to site conditions and to the approval of Owner / Engineer and the local Authority Having Jurisdiction, over the installation;

.2 Perform tests before energizing electrical distribution;

.3 Disconnect ground fault indicator during tests;

.4 Provide test report documenting successful test results.

MOTOR SURVEY SHEET

Motor Name & Number _____

Manufacturer _____

hp _____ Max. Ambient _____ °C

r/min _____ Service Factor _____

Volts _____/_____ / _____ Insulation Class _____

AMPS _____/_____ / _____ EEMAC Design _____

PHASE _____ Time Rating _____

Frame _____ Type _____

Serial # _____

Model # _____

Starter _____ Type _____

OPERATING CONDITIONS

Full Load Operating Amps _____ A _____ B _____ C

Full Load Operating Voltage _____ A-B _____ B-C _____ C-A

at Motor

Overload Relay Installed _____ Adjustable Setting _____ %

M.C.P. AMPS _____ Adjustable Setting _____

Acceleration Time (If over 5 seconds) _____

Reduced Voltage Starter Tap Setting _____

Reduced Voltage Starter Transition Time Setting _____

Special Controls and Remarks (Thermistor and Relay Type, Capacitors and where connected, etc.)

_____

_____

SYSTEM COMPLETION AND COMMISSIONING

SYSTEM: _____

The above system is installed as per the drawings and specifications, is complete and has been commissioned.

Electrical Contractor

Signed by: _____ Dated: _____

General Contractor

Signed by: _____ Dated: _____

Deficiencies Attached

This system has been reviewed by:

Consultant

Signed by: _____ Dated _____

The Owner's personnel have been instructed in the operation and maintenance of the above system:

Owner

Signed by: _____ Dated _____

The above does not constitute a waiver of any of the requirements of the Contract Document.

ELECTRICAL CONTRACTOR	GENERAL CONTRACTOR
Address:	
Phone:	

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 RELATED WORK

1.1.1 Installation of anchor devices, channel base sills, setting templates in accordance with Section 03 30 00 - Cast-in-Place Concrete.

1.1.2 Ensure proper coordination of motors overloads with starter and VFD equipment supplier(s). Motors to be rated 575V supplied at 600VAC, 3 Phase, 3 Wire.

1.2 SHOP DRAWINGS

1.2.1 Submit shop drawings in accordance with Section 26 00 00 – General Electrical Requirements.

1.2.2 Indicate on shop drawings:

.1 Floor anchoring method;

.2 Dimensioned foundation template;

.3 Dimensioned cable entry and exit locations;

.4 Overall length, height and depth;

.5 Dimensioned layout of internal and front mounted components;

.6 Configuration of identified compartments;

.7 Schematics and wiring diagrams for all type of starters;

.8 Configuration section interconnections;

.9 Configuration of the MCC internal communication and main components.

2 PRODUCTS

2.1 APPROVED MANUFACTURERS

2.1.1 Allen Bradley Bulletin 2100 Series M (to match existing) series; or approved Allen Bradley equal

2.1.2 The existing Allen Bradley Bulletin 2100 Series M MCC is
Catalog Number / Serial Number 2100-M5041906/02

2.2 MCC SECTIONS

2.2.1 The new MCC sections shall provide motor control in the form of breakers, Variable Frequency Drive controllers, and provisions for spares as indicated on the drawings. It shall also provide an incoming wire way.

2.2.2 The unit shall be a single sided, front access, NEMA Class II, Type B-T wired MCC, 600V, minimum 600A bus, 3 Phase, 3 Wire, min. 42kA SYM bracing.

2.2.3 The MCC enclosure shall be NEMA Type 1 with gasketed doors. Vertical sections shall be constructed with steel divider sheet assemblies formed or otherwise fabricated to eliminate open framework between adjacent sections.

2.2.4 Structures shall be totally enclosed dead-front, free-standing assemblies. They shall be 2286 mm 90” high and 533 mm 21 inches deep for 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.

2.2.5 A vertical wireway with minimum of 22,580 mm^2 [35 $inches^2$] of cross-sectional area shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain cable supports.

2.2.6 All full voltage starter units through NEMA Size 5 and feeders through up to 600 amperes shall be of the draw-out type. Draw-out provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Draw-out units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend outside of the draw-out unit. Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted, positive latch pull-apart type control terminal blocks rated 300 volts. Knockouts shall be provided for the addition of future terminal blocks. All control wire to be No. 14 AWG, minimum.

2.2.7 All draw-out units shall be secured by a quarter turn, indicating-type, fastening device located at the top left of the unit. With the exception of dual-mounted units, each unit compartment shall be provided with an individual front door.

2.2.8 Doors are to be hinged in a manner that allows for the removal of individual doors without the removal of any door above or below. Unit doors shall be hinged on the left and vertical wireway doors on the right for unobstructed access to the units and associated vertical wireway. All doors shall be mounted on removable pin-type hinges and secured with steel quarter-turn, indicating type fasteners.

2.2.9 Wireways shall be completely isolated from bus compartments by suitable barriers. Sliding barriers between the horizontal bus and top horizontal wireway are not acceptable.

2.2.10 Removable top cover plates shall be provided for conduit/cable entry to the top horizontal wireway and shall provide a minimum of 74,838 mm^2 [16 $inches^2$] of area for conduit location. Top cover plates shall be fabricated from 13 gauge steel.

2.2.11 MCC structure shall be supplied with end-panels that cover the bottom horizontal wireway and ends of the base channel sills. The end panels shall be factory installed to cover the ends of the base channel sills to prevent entrance of dirt and rodents into the MCC when installed flush on the housekeeping pad.

2.2.12 A removable, full-length lifting angle shall be provided for each shipping split of the MCC. The lifting angle shall be bolted to each side sheet or divider sheet of the shipping split to evenly distribute the weight of the MCC during lifting.

2.2.13 MCC shall be assembled in such a manner that it is NOT necessary to have rear accessibility to remove any internal devices or components.

2.2.14 MCC BUS:

.1 The two new mcc sections are to form an extension of the existing MCC. The bussing of the new sections is to be connected to the existing MCC via a cabled connection to a new circuit breaker mounted in the existing MCC. This connection method has been selected to ensure an existing MCC shutdown is not required in order to make this connection.

.2 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 65º C temperature rise over a 40º 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 center feeding, and be fully rated, top and bottom, from centerline bus.

.3 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.

.4 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.

.5 All buses shall be braced for minimum of 42,000 amperes RMS, symmetrical.

.6 A tin-plated 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 located in the bottom horizontal wireway.

.7 The Ground buss is to be extended from the existing MCC via a redundant cabled connection. Each cable is to be of sufficient size to meet the full requirement.

.8 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.

.9 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.

2.2.15 MCC Units:

.1 Plug-in units shall connect to the vertical bus by means of self-aligning, silver plated copper stab-on connectors provided with spring steel back-up (spring reinforced) springs to insure positive connection to the vertical bus.

.2 Stabs on all plug-in units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

.3 A grounding point shall be provided in each unit. This ground point shall be electrically connected to the horizontal ground bus. If vertical ground bus is provided, plug-in units shall include a ground stab which engages the vertical ground bus before the power stabs engage the vertical bus when the unit is inserted into the structure. When the plug-in unit is withdrawn from the vertical bus, the vertical ground stab shall release after the power stabs.

.4 The interior of all MCC units shall be painted white, including unit top and bottom plates or isolation barriers.

.5 All plug-in units 305 mm tall, and larger shall include two (2) lifting points to aid in installation, removal and transporting plug-in units.

.6 Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal.

.7 All plug-in units shall include a racking mechanism to assure full engagement with the stab-on connectors with the vertical bus.

.8 Plug-in units shall be provided with interference type draw-out to prevent complete removal of the plug-in unit from the structure in one motion.

.9 A mechanical interlock shall be supplied on all plug-in units to prevent insertion or removal of a unit from the structure when the unit operator handle is in the ON position.

.10 Each 305 mm tall, and larger plug-in unit shall be secured in the structure by two (2) readily accessible devices, one of which is tool operated. These devices shall be located at the front of the unit.

.11 Plug-in units wiring shall be supplied with unit terminal block mounted adjacent to the vertical wireway. The terminal blocks shall be mounted on a movable bracket that maintains the terminals inside the unit structure for normal operation and exposes the terminals for wiring, test and maintenance.

.12 All plug-in units shall include a positive means of grounding the unit to the structure at all times.

.13 Each MCC unit shall be complete with a lockable, disconnect operating handle and shall be interlocked with the unit door so that the door cannot be opened with the disconnect device in the ON position, nor can the disconnect device be turned ON with the unit door open, except by operation of a defeater mechanism. Status of the disconnect device shall be clearly indicated by the position of the operating handle. When applied with circuit breaker devices, the handle shall also provide clear indication of a circuit breaker trip.

.14 When pilot lights, push buttons or sector switches are specified; the devices shall be mounted in a formed device panel that is capable of accepting up to four - 22mm devices, in any combination. The device panel shall be secured to the unit door or mounted on the plug-in unit as required for unit removal and bench testing.

.15 Control power shall be individual control power transformers located in individual starters and VFDs as shown on the wiring schematic drawings. All control circuit transformers shall have primary protection.

.16 Pilot devices, when specified, shall be 22 mm in diameter, rated for NEMA 4 (IP 67) applications. Pilot status indication lights shall be push-to-test, LED type. Connections to 22 mm pilot devices shall be made to touch resistant screw type terminations. Pilot device contacts shall be rated at 10A, 600 VAC (NEMA A600).

.17 Unit identification nameplate shall be provided for each unit. Nameplates shall be a white surface with black core. Engraving shall cut through the black surface exposing white lettering of the unit designation. Nameplates shall be 25 mm tall x 89 mm wide. Adhesives or glues are not an acceptable means of mounting unit nameplates.

.18 All major component parts such as starters, circuit breakers, combination starters, solid state starters and VFD’s shall be of the same manufacturer.

.19 All 600V equipment in unit compartments (whether draw out or fixed) shall be touch safe by means of suitable shields to block inadvertent contact. Equipment shall include, but not be limited to contactor lugs, fuses, CPT fuses, and similar devices associated with pf capacitors.

2.3 MOULDED CASE CIRCUIT BREAKERS (MAIN AND FEEDERS)

2.3.1 Moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40□C ambient.

2.3.2 Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.

2.3.3 Main incoming circuit breaker shall be complete with solid state LSIG electronic trip unit. They are 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.

2.3.4 Feeder circuit breakers are to be assembled in draw-out unit wrappers.

2.3.5 Common-trip: with through-the-door single handle mechanism for multi-pole applications.

2.3.6 Thermal magnetic moulded case feeder circuit breakers up to 400 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.

2.3.7 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.

2.3.8 Circuit breakers with interchangeable trips as indicated.

2.3.9 Shunt trip circuit breakers shall be as indicated on drawings c/w 120 VAC duty coils and two SPDT auxiliary switches.

2.3.10 Optional breakers features, where indicated on the drawings;

.1 Under-voltage release.

.2 On-off locking provision.

.3 Extra set of position contacts NO / NC.

.4 Solid state trip units.

2.4 OVERLOAD DEVICE

2.4.1 The device must be manually resettable

2.4.2 Mount in cubicle section and wire as per drawings.

2.5 VARIABLE FREQUENCY DRIVES (VFD)

2.5.1 Provide Variable Frequency Drives (VFD) in the MCC, as described in Section 26 29 23 - Variable Frequency Motor Controllers.

2.6 GROUNDING

2.6.1 Copper ground bus extending full width of all cubicles and located at bottom.

2.6.2 Redundant Lugs at each end for No. 3/0 AWG, copper grounding cable.

2.7 FINISHES

2.7.1 Apply finishes in accordance with Section 26 00 00 – General Electrical Requirements:

.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;

.3 Supply two (2) cans of touch-up enamel.

3 EXECUTION

3.1 CONSTRUCTION

3.1.1 Assemble as per plans and specifications.

3.2 SHIPPING

3.2.1 Skid mount the completed MCC sections and wrap with protective cardboard.

3.2.2 Shipping: Include the cost of loading, transportation and off-loading.

3.3 INSTALLATION

3.3.1 Locate and install MCC sections on housekeeping concrete pad, and connect all shipping splits.

3.3.2 Check factory-made connections for mechanical security and electrical continuity.

3.3.3 Make field power and control connections, as indicated.

3.3.4 Ensure correct overload heater elements are installed.

3.3.5 Test and commission the MCC in coordination with Manufacturer's representative. Manufacturer's representative shall sign off on the installation.

TECHNICAL DATA – MCC TESTING

MCC No._____Location_____ Nominal Amps._____

	Specified	**Shop Drawing**	**Installed**	**Verified By**
Manufacturer				
Supplier				
Model No.				
Serial No.				
Enclosure Type				
Voltage & Phase				
Rating Short Circuit Amp. (SYM)				
Horizontal Bussing Ampacity				
Vertical Bussing Ampacity				
Type				
No. of Moulded Case Breakers				
No. of Starters				
No. of VFD’s				
No. of Sections				
No. of Spaces				

STATIC CHECK

Nameplate Complete:		Bus Phasing Identified:	
Warning Sign:		Mounting:	
Clearance:		Wiring Complete:	
Grounding:		Conductors:	
Conduit Secured:		Control Wiring:	
Served From:		Fieldbus – Ethernet:	
Metering Check:		Clean:	

OPERATION CHECK

Amperage “A”:		Voltage – A to B:	
Amperage “B”:		Voltage – B to C:	
Amperage “C”		Voltage – C to A:	
Switches Operate:		Megger Test Complete:	

WARRANTY

Start:

Expire:

NOTES:

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 References

1.1.1 Equipment, products and execution must meet all requirements detailed in Section 26 00 00 – General Electrical Requirements.

1.1.2 The marshalling panel is defined as the panel located in the process area to arrange and group field wiring in proper order and allow for easier installation and troubleshooting.

1.1.3 The local control panel is defined as the panel located where the control processors and/ or associated I/O modules, and various communication modules and equipment are installed, and where all field wiring from the associated instruments is terminated. This panel will be connected to, but installed remotely from, the marshalling panel in a location of easy and unrestricted access for the station operators.

1.1.4 The equipment panel is defined as a weather proof enclosure located at vendor supplied equipment to provide a protective enclosure for electrical equipment provided separately.

1.2 General Requirements

1.2.1 It is not the intent of this specification to completely specify all details of design and construction of the panel, this work is the responsibility of the Contractor.

1.2.2 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 Contractor and shall be carried out in accordance with good engineering practices.

1.2.3 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel, and on the doors without any distortion or deflection.

1.2.4 The enclosures shall be sized to accommodate the proper layout and mounting of equipment devices, as per the contract documents.

1.2.5 The Contractor shall supply all instruments and components mounted on or within the panel, unless otherwise noted.

1.2.6 All free-standing enclosures must be installed on 100 mm concrete house-keeping pads.

1.3 Documentation

1.3.1 The documentation supplied by the Contractor shall include as a minimum:

.1 General arrangement drawings and bill of materials;

.2 Wiring design drawings and wiring diagrams;

.3 Equipment descriptive data.

1.4 Code and Standards

1.4.1 As a minimum, the design, materials and construction of panels, cabinets and racks shall comply with the applicable requirements and recommendations of the following Codes and Standards. The latest edition, as adopted at the time of purchase shall apply:

.1 Canadian Standards Association (CSA)

.1 C22.1 – Canadian Electrical Code, Part 1;

.2 C22.2 – Canadian Electrical Code, latest adopted edition.

1.4.2 Applicable Provincial Regulations.

1.4.3 National Electrical Manufacturers Association (NEMA)

.1 1S1.1 – Enclosures;

.2 1C5 – Enclosures for Industrial Controls and Systems.

2 PRODUCTS

2.1 Panel Enclosures

2.1.1 Provide (NEMA) CSA Type 12 gasketed enclosures in the electrical area.

2.1.2 All enclosures for mounting in the process area outside of any building shall be (NEMA) CSA Type 4X watertight, as a minimum, unless otherwise specified or required to meet the electrical area classification.

2.1.3 All local control panels must have ventilation louvers c/w an exhaust fan and an adjustable thermostat. All local control panels installed outside or non air-conditioned environments shall have an integral heater c/w an adjustable thermostat. Weatherproof louvers for outdoor enclosures

2.1.4 All enclosures to have a corrosion inhibitor:

.1 Daubrite 5 Disk VCI Emitter for enclosures < 5 cu. ft.

.2 Daubrite 10 Disk VCI Emitter for enclosures > 5 cu. ft.

2.1.5 Unless otherwise specified, provide outside finishes on all enclosures in grey, ASA61.

2.1.6 Each enclosure must be supplied with a data pocket for storing wiring diagrams, operation manuals and other documentation inside the enclosure.

2.1.7 Enclosures for equipment in process corrosive atmospheres to be (NEMA) CSA Type 4X, approved for the classification. Stainless steel enclosures shall be used.

2.1.8 Enclosures for mounting field control indicator lamps and switches in unclassified, non-corrosive areas to be approved model die-cast enclosures. Allen-Bradley model 800H-xTZ, or approved equivalent.

2.1.9 Enclosures for mounting field control indicator lamps and switches in classified areas to be approved model stainless steel, or epoxy painted aluminum enclosures.

2.1.10 Supply, fabricate, checkout, layout, document and deliver to the site, fully equipped and functional panels.

2.1.11 Fabricate panels/ enclosures from 12 gauge steel panels c/w the necessary stiffening to form a rigid free-standing lineup. The structures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors. Provide removable top and bottom cable entry plates.

2.1.12 Provide panels with front access only. Doors shall be key lockable and fitted with 3-point, heavy duty latching assemblies. Provide a continuous piano hinge and a pneumatic hold-open device on each door.

2.1.13 Finish the interior of the enclosure with white paint. In the local control panel, provide a switched fluorescent light fixture, a 120 VAC duplex convenience receptacles (UPS & normal power), and a telephone outlet (connected to telephone demark. board) inside the enclosure.

2.1.14 Supply all components contained on or within the panels, fully wired under this section of the specification.

2.1.15 For necessary information regarding the engineering and manufacturing of the local control panel, refer to the indicative layout drawings, the applicable Instrumentation Installation Standard Details, and any loop diagrams shown on the drawings, any other applicable drawings and specifications, and installation and user manuals for the selected equipment.

2.1.16 The local control panel drawings represent a suggested layout. It is the Contractor's responsibility to build the local control panel, based on actual physical dimensions of the supplied equipment and panel components. Final layout and panel size will be determined at the shop drawing approval stage. Fuses required shall be determined based on actual instrumentation provided under this contract. The Contractor and/ or their agents are responsible for the submission of this work.

2.2 Wiring and Accessories

2.2.1 Provide wiring inside the panels according to the following specifications:

.1 Control wiring to be a minimum of No. 14 AWG, tinned stranded copper; RW90 insulation rated at 600 VAC.

.2 Wiring for power distribution shall be a minimum of No. 12 AWG, tinned stranded copper; RW90 insulation rated at 600 VAC.

.3 Analog wiring to be a minimum of No. 16 AWG, single pair copper, 300VAC, CIC, FT-4 rated, white/black cable with overall foil shield and the drain wire. The black wire shall be positive and white wire shall be negative. Drain wires shall be clipped in the field and terminated on individual green/ yellow terminal blocks in the local control panel. The shield shall be grounded at only one end in the control panel grounding terminals, and cut back and insulated at the instrument end.

.4 Refer to the drawings for diagrammatic cable routing requirements outside of the panels (where provided).

2.2.2 Tag each wire at both ends with a heat-shrink sleeve that is machine printed.

2.2.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes. As a minimum separate control wiring from analog signal and communications wiring.

2.2.4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed forty percent (40%) of the cross-sectional area of the wireway.

2.2.5 Provide a minimum clearance of 40 mm between wireways and any point of wire termination.

2.2.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels. Identify each terminal strip with a terminal strip number, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding terminal number appended to it;

.2 Identify every joint and/ or terminal of the above wire run with the same identifier until the wire meets another tagged device, at which point the wire identifier will change to use the new device name and terminal number;

.3 Identify spare wires by using the destination identifier, i.e., the location and terminal identifier of the opposite end of the wire are combined to form the wire tag. All spare wires must be terminated in the dedicated terminals at both ends;

.4 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal block and all external wire connections are made on the outboard side.

2.2.7 Provide a 120 VAC power distribution system and a 24 VDC power distribution system in the local control panel. Provide a thermal magnetic circuit breaker on each main power circuit and a fused terminal block with blown fuse indicator for each branched circuit, off of the mains.

2.2.8 Provide disconnect type terminal blocks Weidmuller, Phoenix Contact or approved equivalent, to isolate field wiring that is power sourced from the local control panel.

2.2.9 Provide sufficient terminals, so that not more than two (2) wires are connected under the same terminal. Provide twenty percent (20%), spare terminal capacity at each terminal block assembly.

2.2.10 Terminals shall be Weidmuller SAK Series, or approved equivalent, type color coded as follows:

.1 Red = Positive 24VDC;

.2 Black = 0VDC Common and analog signal plus;

.3 White = Analog signal common and VAC neutral;

.4 Grey = 120 VAC;

.5 Green = Ground;

.6 Yellow = Shield.

2.2.11 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be black lamacoid with white lettering, a minimum of 25 mm x 75 mm in size with up to three lines of 3 mm lettering. Securely fasten nameplates, and situate them in a visible location.

2.2.12 Every cable entering or leaving the enclosure shall be labeled with permanent marking identification subject to the review by the Consultant.

2.3 Panel Grounding

2.3.1 Provide a noise-free, low-resistance grounding connection using stranded ground wire to all equipment installed in the panel, according to the manufacturer's recommendations and all applicable standards and codes.

2.3.2 Provide a ground system for the instrumentation circuits, isolated from the main power system ground, to each marshaling panel (where applicable).

2.3.3 Provide 25 x 200 mm copper grounding bus mounted in the local control panel c/w grounding lugs, suitable for termination of up to a No. 2 AWG, copper grounding conductor. The grounded bus shall be bonded to the station ground.

2.3.4 Provide in each marshaling panel (where applicable), an isolated grounding buss bar, 6 mm x 25 mm x 600 mm, equipped with the necessary lugs for accepting two (2) No. 2 AWG, grounding conductors. The grounded bus shall be bonded to the station ground.

2.3.5 Firmly bond all panel mounted devices, on or within the panel to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

2.3.6 Bond each enclosure door to the grounding lug.

2.4 Terminals

2.4.1 Provide strap screw type terminal blocks rated for 600 Volts.

2.4.2 Identify each terminal block within an enclosure with a unique machine printed terminal block number. Cabinet chassis grounding terminal blocks to be identified by the electrical ground symbol.

2.4.3 Connections to screw terminals to be locking fork tongue insulated crimp type wire connectors, equal to Panduit PAN-TERM series, or T&B STA-KON series.

2.4.4 Terminals to be Weidmuller, Phoenix Contact or approved equivalent.

.1 Provide a group of terminals for each of 120 VAC hot and neutral and 24 VDC positive and negative power. Distribution wiring to have a thermal magnetic circuit breaker upstream of all major blocks of loads, adequately sized to protect the connected load while not causing nuisance tripping. Provide nickel-plated terminals for all high capacity applications in excess of 15 Ampere.

2.4.5 Provide Weidmuller or Phoenix Contact disconnect type terminal blocks c/w fuses for each load, or loop powered from the local control panel.

2.4.6 All terminals shall be identified with marker pins and/ or strips.

2.5 Nameplates

2.5.1 Refer to Section 26 00 00 – General Electrical Requirements for nameplate specification.

2.6 Consumables

2.6.1 Supply all consumables such as fuses, lamps, bulbs, etc., until and during start-up and commissioning. At completion of commissioning, provide a ten percent (10%) spares inventory, for each type of consumables.

2.6.2 Provide a tabulated list of all consumables utilized, indicating where used, type, rating, and reordering information. Include the list with the Operation & Maintenance manual submission.

3 EXECUTION

3.1 References

3.1.1 Refer to Section 26 00 00 – General Electrical Requirements, Part 3.

3.2 Mounting Heights

3.2.1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects at 2000 mm above floor to top cover of enclosure.

3.3 Identification

3.3.1 Each enclosure shall be clearly identified with a 0.1” thick lamacoid nameplate black face and white core, mechanically attached with self-tapping screws to the panel door. The nameplate to indicate panel name, as indicated on drawings, and as confirmed with the Owner.

3.3.2 If more than one power source is present in a panel, a separate warning nameplate with red face and white core, mechanically attached with self-tapping screws to the panel door shall be provided. The nameplate shall indicate the number of power sources and the supply panelboard.

3.3.3 All instruments within the panel shall be identified as per Section 40 90 00 – Instrumentation and Control for Process Systems, and the contract drawings.

3.3.4 Provide a list of all circuit breakers and fuses laminated in plastic. The list shall be located in each associated enclosure.

3.3.5 All wires shall be identified.

3.4 Installation

3.4.1 Locate enclosures, as indicated on the drawings.

3.4.2 Connect the instrumentation, power, control, communication and field wiring.

3.4.3 Conduit and cable entrance shall be from bottom only, unless otherwise specified.

3.5 Related Work

3.5.1 Interconnection to the associated panels terminal strips, communication and field devices.

3.5.2 Installation of interconnecting cables to field devices, instruments and communication devices.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Related Work

1.1.1 Refer to Section 26 27 16 – Electrical Cabinets and Enclosures.

1.2 Shop Drawings

1.2.1 Submit shop drawings and product data in accordance with Section 26 00 00 – General Electrical Requirements.

2 PRODUCTS

2.1 Related Work

2.1.1 Interconnection to associated device terminal strips and field devices.

2.1.2 Installation of linkage conduits and cables to remote field devices and instruments.

2.2 Enclosures

2.2.1 All enclosures in electrical room shall be CSA Type 12, gasketed, unless otherwise indicated.

2.2.2 All enclosures in pump room area shall be CSA Type 4, unless otherwise indicated.

2.2.3 All enclosures located outdoors shall be CSA Type 4X stainless steel.

2.3 Control Devices

2.3.1 All control devices shall be equal to Allen-Bradley 800 T Series for general purpose and Allen-Bradley 800 H Series for Corrosion Resistant and Hazardous locations, for local control stations (e.g. pushbuttons and selector switches) shall be equal to quality of Allen-Bradley Type 800 T and/ or 800 H.

2.3.2 Enclosures shall be as specified under Clause 2.2 of this section.

2.3.3 Pilot lights shall be transformer type with LED lamps for extended lamp life, oil tight, push to test, complete with appropriate color lenses. Normal colors used are ‘Run/ On/ Open’ = Green, ‘Stop/ Off/ Closed’ = Red, or unless otherwise specified elsewhere.

2.4 Control Panels

2.4.1 Control panels as defined in Division 25.

2.5 Finishes

2.5.1 Apply finishes in accordance with Section 26 00 00 – General Electrical Requirements.

2.6 Equipment Identification

2.6.1 Provide equipment identification in accordance with Section 26 00 00 – General Electrical Requirements.

2.6.2 Nameplates:

.1 Black plate, white letters, Size 1.

2.7 Wire Markers

2.7.1 All wiring shall be identified with Grafoplast removable sleeve type wire markers.

2.7.2 Model 102/20 Wire Markers, 20 mm for No. 12-14 AWG wiring.

2.7.3 Model 1117/M Wire Numbers consisting of Alpha and Numeric characters as shown on the drawings or specified herein.

2.7.4 Characters shall be black on white background.

2.7.5 Manufacturer, Grafoplast Wiremarkers Inc.

2.7.6 Alternatively, Contractor can propose the following for Engineer review:

.1 Wiring identified by thermoplastic PVC sleeve type wire markers;

.2 Wire markers of the individual interlocking type assembled to compose the wire number, or;

.3 Wire markers of the continuous tubular sleeve type, custom hot stamped with the wire number.

2.8 Control Panel Wiring

2.8.1 Control panel wiring as defined in Division 25.

3 EXECUTION

3.1 Not Used

3.1.1 Not used.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Description

1.1.1 Provide disconnect switches for 347/600 volt and 120/208 volt distribution as indicated on the drawings, as manufactured by Cutler Hammer, Schnieder or Square D.

2 PRODUCTS

2.1 Disconnect Switches

2.1.1 Ratings: 600 Volts for 347/600 volt distribution, 240 volts for 120/208 volt distribution. Unless otherwise shown, 3 pole for 3 phase, 3 wire distribution, 3 pole and solid neutral for 3 phase 4 wire distribution. Ampere ratings as shown on the drawings or to suit load requirements. For motors, use disconnect switches with HP ratings at least equal to motor HP.

2.1.2 Enclosures: CSA code gauge galvanized steel, hinged doors, external operating handles. Disconnect switches in dry locations shall be EEMAC-1 and EEMAC-3 where exposed to weather. Provide ON-OFF switch position indication on switch enclosure cover.

2.1.3 Finish: One primer coat and one finish coat on all metal surfaces, colours as per Section 16010 - Electrical General Requirements.

2.1.4 Switch mechanisms: Quick make and quick break action with self wiping contacts, solderless pressure lug connectors. For switches 100 amperes and over, provide non-tracking arc shrouds. All switch poles to operate together from a common operating bar. Provide for padlocking disconnect switches in "Off" position. Doors to be interlocked and complete with defeat mechanism, to prevent opening when handle in ON position.

2.1.5 Neutral Bars: Where distribution system has grounded neutral conductor, provide neutral bar where required with ampere rating equal to switch rating, in enclosure. Provide ground bar for terminating ground conductors.

2.1.6 Fuse Holders: Provide fuse holders (relocatable and suitable without adapters) on load side of switches, ampere rating equal to switch ratings, suitable for fuses specified.

2.2 Fuses

2.2.1 All fuses to be 100,000 ampere (minimum) interrupting capacity of the current limited type. In addition, fuses feeding motors to be of the time delay type. Provide one full set of spare fuses, three for each different ampere rating used, stored in suitable enclosure.

3 EXECUTION

3.1 Disconnect Switches

3.1.1 Mounting: Provide supports independent of conduits. Wall mount where possible, otherwise provide Unistrut frame support. Where switches are grouped mount in uniform arrangement.

3.1.2 Wiring: Connect line and load cable to all switches.

3.1.3 Fuse Rating: Install so that rating is visible.

3.1.4 Identification: Provide lamacoid plate in accordance with Section 16010 - Electrical General Requirements, on each switch showing voltage, source of supply and load being fed, for example:

Door Controller
120/208 Volts
Fed from PPA

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Related Work

1.1.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.1.2 The contractor shall supply, install, and make operational all Variable Frequency Drives (VFD) as shown on the Electrical Drawings, Single Line diagrams, Wiring Schematics and as specified herein.

1.1.3 Variable Frequency Drives shall be capable of continuous, high-efficiency operation of squirrel cage, induction type motors that drive variable torque type loads, or constant torque type loads where applicable.

1.1.4 Drives shall be able to operate motors to the minimum speed compatible with the pumping requirements.

1.1.5 VFD's must meet IEEE 519 with respect to generated harmonics and THD, conform to the Supply Utility's Power Quality Requirements, and with the point of common coupling (PCC) considered the 600V service entrance connection for levels defined in IEEE 519.

1.1.6 Refer to specifications Section 26 24 19 – Motor Control Centre for Variable Frequency Drive installation(s) in MCCs.

1.2 Shop Drawings

1.2.1 Submit shop drawings in accordance with Section 26 00 00 - General Electrical Requirements.

1.2.2 Variable Frequency Drives are to be supplied integral as part of the MCC supply package. Include all shop drawings relevant to VFD in the MCC shop drawing package.

1.2.3 Indicate on shop drawings:

.1 Dimensioned outline drawing showing overall length, height and depth.

.2 Dimensioned cable entry and exit locations.

.3 Schematic and wiring diagrams.

.4 Dimensioned layout of internal and front mounted components.

.5 Configuration of identified compartments.

.6 Power and Control connection diagrams, including all communications features.

.7 Product performance sheets.

.8 Provide a complete harmonic analysis of the electrical system, detailing the expected performance of the harmonic mitigation system to be supplied (refer to Harmonic Mitigation specifications in paragraph 2.8, below).

1.2.4 Provide operation and maintenance data for Variable Frequency Drive controllers, including the following:

.1 All approved shop drawing information listed above.

.2 Troubleshooting flowcharts for all device faults.

.3 An instruction manual for programming and hardware provided with the equipment at time of shipment.

1.2.5 Provide the Client with VFD communication software and cable required to connect a laptop to the VFD for troubleshooting and data gathering.

1.3 Codes and Standards

1.3.1 All equipment shall be designed, manufactured, and tested in accordance with the latest editions of CSA, ANSI, IEEE and NEMA standards and, in particular, the following:

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

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

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

.4 Equipment shall have CSA approval by a recognized certification agency.

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

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

.7 CSA Standard C22.1 Canadian Electrical Code as adopted by the Province of British Columbia.

.8 IEEE 519: Guide for Harmonic content and Control.

.9 IEC 61800-2 and -3 EN 50082-1 and -2 EMC immunity requirements.

1.4 Design Criteria

1.4.1 All items listed in this Section shall be capable of satisfactory operation indoors, installed integral to a motor control centre, and shall be suitable for connection to, and operation on, the following plant electrical system:

.1 Low Voltage System Characteristics:

Nominal system voltage, V	600
Phase	3
Frequency, Hz	60
Available Fault Current	35,000A RMS symmetrical
System Neutral	Solidly grounded

1.4.2 Fault Availability: The Variable Frequency Drive assemblies shall be designed for an available fault level of 35kA RMS symmetrical (minimum) at the incoming terminals;

1.4.3 Ambient temperature (Basis for Design): 40▫°C maximum;

1.4.4 Where a voltage disturbance exceeds the VRD's process controller capability to maintain drive operation, the drive must have 'flying start' functionality.

2 PRODUCTS

2.1 General

2.1.1 The following does not constitute a complete equipment specification, but outlines the general scope and special features of the equipment required. This section to be read in conjunction with Section 26 24 19 – Motor Control Centre.

2.2 VFD Cabinets

2.2.1 VFDs are to be supplied as part of an integral, factory-assembled motor control center package.

2.2.2 Loose VFD's shall be suppled in a single dedicated enclosure for mounting within a single weatherproof enclosure or an outdoor kiosk suitably sized to hold multiple VFD's.

2.2.3 VFD cabinets shall have door-mounted HMI interface and controls interface.

2.2.4 VFD disconnecting means (circuit breaker) shall be provided at the VFD cabinet section or the upper right corner of loose VFD Cabinets.

2.2.5 To ensure a properly coordinated system, all drives and ancillary components shall be the product of one manufacturer, and shall be provided by the authorized local representative who has both sales and technical service for sole-source responsibility.

2.2.6 Use standard designs and factory pre-assembled VFD sections, fully tested prior to delivery to site. No field modified systems will be allowed.

2.2.7 The Supplier shall be responsible for coordinating the requirements of the drive, harmonic mitigation strategy and motor characteristics with the motor control center, process equipment, and drive suppliers. The coordination shall include, but is not limited to, the following:

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

.2 Ensuring complete compatibility of the drive's current limit (thermal overload) protection with the motor thermal withstand capability; and,

.3 Confirm harmonic mitigation sizing to meet the motor requirements and power system requirements as specified.

2.2.8 Drives shall be suitably rated for the full load amps of the specific motor served, operating at specified service factor at installed altitude and expected high ambient temperature. Drive and motor horsepower, where shown on drawings or specified elsewhere, shall be for information only and not as direction to the Contractor for equipment sizing. Actual sizing shall be coordinated and verified with the equipment and motor suppliers;

where a larger drive is required as a consequence of this coordination, the larger unit shall be supplied and any associated costs shall be included in the bid price.

2.2.9 The Supplier shall be responsible for coordinating the harmonic mitigation strategy with the drive and MCC supplier to ensure full compatibility.

2.2.10 A load side long line or dv/dt filter shall be provided.

2.2.11 Controlled acceleration and deceleration times, separately adjustable, shall be provided. The supplier shall provide adjustable damping for the response to speed change.

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

2.2.13 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.

2.2.14 The product 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.

2.2.15 Audible noise levels produced by the drive shall be not greater than 80 dBA sound pressure when measured at one meter, at any point throughout the operating range of the drive.

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

2.2.17 The listing of specific manufacturers does not imply acceptance of their products which do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

2.2.18 Acceptable Manufacturer for Variable Frequency Drives:

.1 Allen Bradley Powerflex 700 Series

.2 Eaton Cutler-Hammer (SPX9000) series, or Eaton DG1;

.3 No substitutions.

2.2.19 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 1,100 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 also extend life of the fan due to prolong idle time of the pumps.

.5 Drives will be installed in motor control centre.

2.2.20 Drive Construction:

.1 Design the VFD cabinets to provide for ease of maintenance.

.2 The VFD shall consist of the following major components:

.1 3-pole circuit breaker.

.2 Input rectifier section to supply fixed DC bus voltage.

.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) or load filters to control output voltage spikes and to control rise times of the output pulses, to permit use of long motor leads and control cables.

.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 harmonic mitigation, as specified herein, to limit total harmonic distortion (voltage and current) to levels specified.

.10 The VFD shall have a nominal current rating at least 10% in excess of the motor nameplate full load amp rating. Overload service factors of 150% for one minute must be provided to ensure adequate safety margins.

.3 For each VFD, include as standard, a door mounted operator interface module with backlit LCD display to configure VFD parameters, and display operation and fault code diagnostic information. Module is to be mounted on the VFD cabinet door.

.4 Separate the VFD power terminal blocks physically from control signal terminal blocks.

.5 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’s from the same manufacturer.

.6 Provide a complete inventory (as specified) of spare cooling fans, and fuses, for each VFD supplied.

2.3 Motor Operations

2.3.1 Unless otherwise noted elsewhere, inverter-rated AC induction motors shall be used to operate loads over a 35 to 110% speed range reaching rated nameplate horsepower (HP) at 60 Hz.

2.3.2 Motor operation may be continuous or intermittent with frequent starting and stopping.

2.4 Input Power

2.4.1 Unless otherwise specified, the VFD shall accept nominal 600 VAC ±10% 3Ø, 60 Hz, power supply, with line frequency variation of up to +/-5 Hz.

2.4.2 VFD's shall have nominal voltage rating of 690 V AC; if this rating is not available, confirm acceptability of product with Engineer minimum of ten (10) days prior to bid close.

2.4.3 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.

2.4.4 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 drive trips on undervoltage, the drive shall activate the Automatic Restart/Reset for undervoltage trips and utilizing the flying start function to allow the drive to restart immediately when the power returns, if in "Remote" and the control calls for the drive to run. The VFD shall match the motor rotating speed and take control.

2.4.5 The VFD shall present a displacement power factor of 0.95 lagging or better to the AC line at any speed or load.

2.4.6 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 drive and measuring motor output on a dynamometer.

2.4.7 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 VFD are operated from the same bus.

2.4.8 The VFD shall not require an input isolation transformer.

2.4.9 The VFD shall not be sensitive to supplied power that has one phase grounded (Delta) or referenced to earth ground (WYE).

2.4.10 The VFD shall not be sensitive to incoming phase sequence.

2.4.11 The VFD shall include transient voltage suppression to allow reliable operation encountered in an industrial power distribution system.

2.5 Output Power

2.5.1 The VFD shall produce a three-phase output for the motor load.

2.5.2 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.

2.5.3 Unless otherwise specified, the standard VFD output frequency shall be adjustable from 10 to 66 Hz.

2.5.4 Unless otherwise specified, the VFD output voltage shall be adjustable from 0 to 600 V AC, reaching 600 V AC at 60 Hz.

2.5.5 Unless otherwise specified, the VFD shall produce a reduced volts-per-hertz (V/Hz) ratio in the below 60 Hz range.

2.5.6 Unless otherwise specified, the VFD shall supply a constant 600 V AC output when operating above 60 Hz.

2.5.7 The volts-per-hertz output of the VFD shall not be affected, or require readjustment when other drive adjustments (such as maximum speed) are changed.

2.5.8 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.

2.5.9 When subject to the range of ambient conditions stated herein, the VFD shall be capable of maintaining 100% of rated output current continuously.

2.5.10 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.

2.5.11 The VFD output waveform shall be the PWM type waveform producing smooth torque at low frequencies and low harmonics.

2.5.12 The VFD shall have a programmable PWM carrier frequency. Minimum PWM frequency range of 2 - 15 kHz.

2.5.13 The VFD shall be capable of operating output open circuited with no fault or damage for start-up and testing purposes.

2.5.14 Manufacturer shall indicate, at time of tender, the anticipated levels of audible and electrical noise, harmonics and heat generated. These levels shall meet the specification and be warranted and supported by actual test data. Failure to provide this information shall be grounds to reject the proposed drive.

2.6 Protection Systems

2.6.1 The drive shall be capable of withstanding up to 35 kA symmetric short circuit current.

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

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

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

2.6.5 The drive shall not be affected by radio frequencies emitted by portable radio transmitters.

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

.1 Under/over voltage.

.2 Incoming power system phase loss
.3 Overcurrent.
.4 Over temperature.
.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.

2.6.7 Provide minimum two programmable form C contacts (with interposing relays) for alarming of any above items to PLC for remote alarm "VFD FAULT".

2.6.8 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 drive shall self reset and start automatically if in "Remote" and the control calls for the drive to run.

2.6.9 VFD output faults and short circuit faults shall be manual reset at unit HMI.

2.6.10 Provide motor thermistor card.

2.7 Control Features

2.7.1 Provide complete integrated control and metering as follows;

.1 Door mounted Hand-off-Remote selector switch.
.2 Door mounted Forward-Reverse selector switch, where indicated.
.3 Door mounted non-resettable elapse time hour meter.
.4 Adjustable linear acceleration and deceleration from 1.0 to 25 seconds.
.5 Adjustable maximum drive output voltage.
.6 Adjustable maximum voltage/hertz.
.7 Adjustable IR compensation.
.8 Adjustable slip compensation.
.9 Adjustable current limit from 10 to 150%.
.10 Adjustable minimum speed, 0 to 50%.
.11 Adjustable maximum speed, 50 to 110%.
.12 Bumpless speed transfer.
.13 Input terminals for remote interlocks. Allow for two interlocks.
.14 Sufficient I/O for all discrete and analog signals as indicated on contract drawings and wiring schematics.
.15 Minimum of four (4) discrete relay outputs.

2.7.2 The VFD shall have communications capability to interface with the facility local control panel (LCP) via MCC's network (Devicenet).

2.7.3 Surge Suppression

.1 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 freewheeling diodes to limit inductive surges to 28 V peak.

2.7.4 Human-Machine Interface (HMI) on VFD Front Door

.1 Provide a digital local operator interface on the drive door complete with the following features as a minimum:

.1 Speed raise/lower pushbuttons with digital frequency display for local speed adjustment.

.2 FAULT RESET pushbutton.

.3 VFD RUN indicator.

.4 VFD FAULT indicator.

.5 Parameter selection and programming capability

.2 VFD's shall be provided with the ability to run from two separate locations: from a field-mounted control station and remotely via the station's PLC system (Remote). Refer to contract drawings for additional details.

.3 The VFD shall shut down in a controlled fashion when operator station is disconnected or Hand-off-Remote switch is in "Off" position.

2.7.5 Speed Control

.1 Speed control mode selection as follows:

.1 Hand: Speed set point from field-mounted 4-20 mA speed selector where indicated on drawings.

.2 Hand: Speed set point from drive HMI keypad setting.

.3 Remote: Speed set-point from LCP system, via 4-20 mA analog signal with provision for network Ethernet communication control via Modbus/TCP protocol.

2.7.6 Control Functionality

.1 Field selector switch set to "Remote" enables the motor to be started, stopped and speed controlled by the PLC as shown on the drawings. Network Ethernet communication module with Modbus/TCP protocol shall be provided.

.2 Field selector switch set to "Hand" enables motor to be started, stopped and speed controlled from the field operator station.

.3 Field selector switch set to "Off" will stop the motor.

.4 The Supplier's control system integrator (must be approved by the Consultant) will program the PLC to control and monitor the VFD's in accordance with the control philosophy included in specifications.

2.8 Filters And Harmonic Mitigation

2.8.1 The VFD manufacturer shall provide integrated harmonic mitigation, dv/dt filter, RFI filters and TIF filters, plus all accessories required to meet performance criteria as defined herein.

2.8.2 Drives shall be supplied with an acceptable means to limit harmonics, interference and noise as noted in these Specifications.

2.8.3 Harmonic Distortion shall be limited by means of passive harmonic filters, line reactors, DC chokes, or a tested combination thereof. Any harmonic reduction strategy used (except where Contractor proposes active filtering) must be supplied by a single supplier; combination of several different supplier solutions is not permitted.

2.8.4 Performance Criteria - Harmonic Distortion:

.1 Harmonic loading will not exceed a motor service factor of 1.0

.2 Maximum total voltage demand distortion (TDDv) with all duty equipment in simultaneous operation shall be less than 5%. This reading will be verified during commissioning at the switchboard customer (info) meter.

.3 Maximum harmonic current distortion of waveform (% of fundamental) at the 600V service entrance coupling (PCC) shall be as per IEEE 519 (latest edition), Table 10.3; IEEE-519 definition of PCC is superseded by this specification. The ratio of ISC/IL (ratio of short circuit current available to maximum fundamental load current) for this project is expected to be ~20. Notwithstanding IEEE 519 requirements, on this project, for this ratio, the current distortion limits are as follows:

.1 Where is the harmonic multiple of the 60 Hz base frequency

h < 11	=	4.0%
11 < h < 17	=	2.0%
17 < h < 23	=	1.5%
23 < h < 35	=	0.6%
35 < h	=	0.3%

.2 Total current harmonic demand distortion (TDDi) shall be less than 5% when measured at the PCC (as defined previously).

.3 Provide components, as required, to de-tune the system to eliminate destructive overcurrents and overvoltages, and to prevent attraction of harmonics from other sources.

.4 Compliance shall be verified with on-site field measurements of both the voltage and current harmonic distortion at the customer info meter, by comparison with and without the VFDs operating.

.5 Harmonic mitigation methods shall be provided accordingly, such that the maximum harmonic distortion

does not exceed the above limits, at the PCC, under worst-case conditions.

.6 The harmonic mitigation methods used shall not cause any interference with the facility's control system, nor cause a leading power factor due to capacitive components under any load scenario (including no load).

.7 The Supplier shall provide, as part of the tender bid, a technical description of the proposed harmonic mitigation strategy. This description shall include details of what is being supplied to meet the requirements of this specification. This mitigation strategy will be evaluated by the Engineer.

.8 At the time of shop drawing review, the Contractor shall provide a full harmonic analysis of the complete electrical system, from the secondary of the utility transformer to the loads, detailing the expected performance of the harmonic mitigation strategy proposed by the equipment supplier. The analysis shall include TDD (voltage) at the PCC, and TDD (current) at the PCC. It shall provide detailed harmonic levels to the 50th order. This analysis will be reviewed by the Engineer to ensure the solution provided will meet the harmonic requirements of this specification prior to final approval of the equipment. If the analysis determines that these specifications will not be adequately met by means of the proposed solution, the Contractor shall provide additional or alternate means to meet the requirements at no additional cost.

2.8.5 Performance Criteria - RFI and TIF

.1 Acceptable level of telephone interference factor TIF shall be with I*T less than 1500 balanced, and less than 100 residual, at the PCC.

.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

2.9 Shutdown Caution Label

2.9.1 VFD disconnect breakers shall be labeled with proper shutdown procedures as follows:

.1 "Caution"

.1 "* Ensure VFD is stopped before operating this switch"

.2 "* Record all faults before resetting"

2.10 Finishes

2.10.1 Apply finishes in accordance with Section 26 00 00 - General Electrical Requirements.

.1 Same as MCC, see Section 26 24 19 - Motor Control Centres.

3 EXECUTION

3.1 Construction

3.1.1 Assemble as per plans and specifications.

3.2 Factory Testing

3.2.1 Factory test shall be performed to verify that the VFD systems conform to the specifications.

3.2.2 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.

3.2.3 The Contractor, in coordination with the VFD and motor suppliers, shall ensure motor/pump 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 arching at the bearing shall be repaired at Contractor's expense.

3.2.4 It is the intent of this specification to provide a VFD and harmonic mitigation installation that does not adversely affect any other electrical system in the facility.

3.2.5 Provide certified copies of all production test results required by CSA and NEMA.

3.2.6 The Engineer reserves the right to witness the factory tests. Notify the Engineer twenty (20) working days in advance that the assembly is ready for testing.

3.3 Shipping

3.3.1 VFD's shall be shipped to site integral with the MCC packages.

3.3.2 Shipping: Include the cost of loading, transportation and off-loading.

3.4 Installation

3.4.1 Check factory-made connections for mechanical security and electrical continuity.

3.4.2 Make field power and control connections as indicated.

3.5 Spare Parts And Maintenance Materials

3.5.1 Provide spare parts and maintenance materials based on manufacturer's recommendations.

3.5.2 As a minimum, the spare parts shall include the following;

.1 Power fuses – set of 3 for each size used.

.2 Control fuses – 10 of each size used.

.3 Indicating lights – 6 lamps of each type used.

.4 Control transformer – 2 of each size used.

.5 Other field-replaceable items – 2 sets component parts.

.6 VFD cooling fans – 2 of each size used.

.7 Any other additional components, which the VFD vendor recommends to be kept as spares for emergency repairs.

3.6 Testing & Commissioning

3.6.1 Tests in accordance with Section 26 08 00 – Commissioning of Electrical Systems, of the specifications and manufacturer's instructions.

3.6.2 Operate breakers, contactors, and VFD's to verify correct functionality prior to connecting to equipment motor load.

3.6.3 Perform starting and stopping sequences of starter equipment and relays.

3.6.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.6.5 Only factory-trained, manufacturer authorized technicians shall commission the drive upon final installation and after connection to the motor load(s).

3.7 Warranty

3.7.1 The vendor supplying the equipment shall provide the Owner with a warranty with each respective item of equipment supplied. This warranty shall include conformance to this specification with regards to THD, RFI and EMI emissions.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Related Work

1.1.1 Mechanical: Division 15

1.1.2 Motor Starters: Section 16811

1.2 Requirements

1.2.1 Provide a complete system of wiring to motors and controls as specified herein and as shown on the drawings.

1.2.2 Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under all contracts related to this project. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied under other contracts.

1.2.3 All control wiring diagrams shown on the drawings illustrate typical control circuits applicable to the equipment. Control circuits may vary with different manufacturers of equipment. Verify all control circuits with the suppliers of the equipment and make any corrections that may be required.

1.2.4 Unless specifically noted otherwise, supply all pushbuttons, relays, starters, etc., necessary for the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors.

1.2.5 Do not operate motors and controls until approval is obtained from the trade providing equipment.

1.2.6 Examine drawings and shop drawings of other Divisions to obtain exact location of motors and equipment shown on drawings. Where necessary, obtain conduit locations from other trades' drawings and shop drawings.

1.2.7 Assist in placing in operation all mechanical equipment having electrical connections.

1.2.8 Provide three phase starters with fused 120 volt control transformers and overload relays.

1.2.9 Provide all power wiring for all motors and control wiring as indicated on the drawings.

1.2.10 In general, wiring for freezestats, P.E. switches, dampers, temperature controllers, flow switches, solenoid valves, etc., for heating ventilating and air conditioning equipment will be provided under this division. Where 120 volt power is required for mechanical equipment wiring to the equipment terminals is the work of this Division.

1.2.11 Refer to Motor Control Equipment details on the mechanical drawings.

1.2.12 Some specific definitions of equipment wiring responsibilities are as follows:

.1 Fans

.1 Provide all 120V and 208V power wiring. Except where specifically noted otherwise, all control for EF-01 is to be continuous operation through a local disconnect switch

.2 Unit Heaters

.1 Provide power wiring and local disconnects for unit heater fans. Provide, install and wire line voltage thermostats.

.3 Hot Water Tank

.1 Provide 600V power supply to the unit. Control of the unit is to be through integral onboard thermostatic controls.

2 PRODUCTS

2.1 3 Phase Motor Disconnect Switches

2.1.1 Industrial Type "A", having quick make, quick break visible blade mechanism, cover interlocks and padlocking switch in the closed or open position. Use EEMAC 4 enclosures outdoors, and EEMAC 1 indoors switches to be H.P. rated, Westinghouse heavy duty type.

2.2 120 Volt, 1 Phase Disconnect Switches

2.2.1 Manual starter without overload relay.

2.3 208 Volt, 1 Phase Motor Disconnect Switches

2.3.1 Manual starter without overload relay.

3 EXECUTION

3.1 Installation

3.1.1 Provide disconnect switches adjacent to all motors.

3.1.2 Provide all wiring between all force flow and unit heaters and their thermostats. Install wiring between all flow switches and valve monitors and the fire alarm panel.

3.1.3 Do control wiring as indicated on the drawings and the motor control schedules.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Related Work

1.1.1 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

1.2.1 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:

.1 Lighting Luminaires and Supports;

.2 Lamps;

.3 Exterior Lighting Control;

.4 Ballasts;

.5 Accessories.

1.3 Coordination With Other Sections

1.3.1 Coordinate with other Divisions to avoid conflicts between luminaires, landscaping, supports, fillings, civil works, and mechanical equipment.

1.4 Submittals

1.4.1 Submit Shop Drawings for all luminaires that shows all pertinent physical characteristics.

1.4.2 Construction and performance of luminaires, subject to approval of the Engineer.

1.4.3 Provide, if requested by the Engineer, complete photometric data and heat dissipation reports from independent testing laboratory.

1.5 Sample Luminaires

1.5.1 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.

2 PRODUCTS

2.1 Products

2.1.1 Luminaires supplied shall be in accordance with the luminaire schedule or approved equal.

2.1.2 Execution

2.2 Lighting Installation Check List

2.2.1 Luminaires are mounted and secured in an approved manner.

2.2.2 Luminaires are free of scratches, dents, breaks, paint, or defects.

2.2.3 Luminaires are clean and lamped.

2.2.4 Luminaires are fully operational.

2.2.5 Lighting levels appear to be adequate for the space, task and occupant type.

2.2.6 Lighting levels for areas requiring general illumination are uniform.

2.2.7 Color temperature and color rendering (CRI) of lamps agrees with specifications and drawings.

2.2.8 Lamp wattages conform to specifications and drawings.

2.2.9 Lamps are operating properly.

2.2.10 Ballast noise is not excessive or unusual. Ballasts are sound rated as per specification.

2.2.11 Luminaires are approved for the location in which they are placed.

2.2.12 Lighting equipment and lamps are new.

2.2.13 Luminaires are supplied and installed are as per the luminaire schedule.

2.2.14 Spare lamps and parts are available as per specifications.

2.2.15 Luminaires that are required to be aimed or directed are aligned to produce the desired results.

2.2.16 Wattages recommended as maximums for use in a luminaire are not exceeded.

2.2.17 Overcurrent protection of lighting loads meets code standards.

2.2.18 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.

2.2.19 Recessed downlights are rated for mounting conditions (if recessed downlight is blanketed with insulation it must be approved as such).

2.2.20 Teck 90 rated conductors are used to supply the source to the luminaires.

2.2.21 Flexible wiring to recessed luminaires laid within a T-bar ceiling is independently supported.

2.2.22 Polarized lamp holders are properly connected (white wire goes to screw shell and the black wire goes to the center pin).

2.2.23 Luminaires are bonded.

2.2.24 Suitable guards, screens or materials are used on luminaires that are located in areas subject to mechanical damage.

2.2.25 Acrylic material or better to be used as lens material for luminaires. Styrene not permitted.

2.2.26 Illumination levels are adequately provided by the emergency lighting system in the event that normal power is lost.

2.2.27 Emergency lighting battery packs (unit equipment) are connected to an un-switched AC source.

2.2.28 Voltage drop to remote mounted emergency light within the allowable code limit.

2.2.29 Illuminated exit signs located as per code and as per the requirements of the specifications and drawings.

2.2.30 Exit signs are illuminated when normal power is lost.

2.2.31 LED type of illuminated exit signs are used wherever and whenever possible.

2.2.32 Emergency lighting system is tested.

2.2.33 Illuminated exit signs are supplied from a dedicated electrical circuit or circuits.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 The Work includes the provision of all necessary testing, instrument calibration, and installation verification, complete with written reports prior to system completion. After system completion (or part thereof), the Contractor shall commence commissioning and start-up activities as specified in Section 26 79 50 – Controls and Instrumentation System Commissioning and Start Up and Section 26 99 20 – Electrical and Instrumentation System Personnel Training.

1.2 Refer to Section 40 90 00 – Instrumentation for Process Control General Provisions for general instrumentation and control requirements related to testing, calibration, and installation verification.

2 PRODUCTS

2.1 NOT USED

2.1.1 Not used.

3 EXECUTION

3.1 TESTING

3.1.1 Prior to the completion of the Work, perform comprehensive testing of the installation including the following activities:

.1 Pressure testing of all piping systems;

.2 Wire insulation tests;

.3 Wire continuity tests including associated terminations in RTU panel;

.4 Grounding system continuity and isolation tests;

.5 Any other testing necessary to verify the operation of equipment and installation work.

3.1.2 Where appropriate, provide the services of a manufacturer's representative for equipment to assist with any of the equipment tests to be performed. Any components, incorrect wiring, or systems found to be defective or deficient during the tests shall be repaired or replaced.

3.1.3 Coordinate testing schedules with the Consultant.

3.1.4 The participation in testing activities and use of the equipment during testing periods by the Owner shall be allowed provided it does not adversely affect specified testing requirements. Such participation does NOT relieve the Contractor of any of the obligations, as stipulated herein.

3.1.5 Prior to the commencement of any testing, the Contractor shall ensure that all spare parts, expendables, and test equipment pertinent to the system being tested are on site. Test equipment shall include all necessary multi-meters, process instrument calibrators for 4-20 mA, 24 VDC devices and signal generators or simulators. Test equipment shall

be provided by the Contractor and shall remain the property of the Contractor at the end of all testing

3.2 CALIBRATION

3.2.1 On site, calibrate and adjust all instrumentation to verify correct operation, range adjustment, compensation, scaling, etc. Provide instrument calibration services for all individual components such as signal transmitters, analyzers, transducers, power supplies, and like equipment where appropriate.

3.2.2 Provide certified calibration reports for each instrument. In the reports, include, but do not limit to, such information as:

.1 Device tag number;

.2 Equipment description;

.3 Service application;

.4 Process variable measurement range;

.5 Description of calibration equipment used;

.6 'As found' calibration data;

.7 'As left' calibration data;

.8 Date, name, and signature of technician.

3.2.3 Include calibration reports in the operating and maintenance manuals described in Section 40 90 00 – Instrumentation for Process Control General Provisions.

3.3 INSTALLATION VERIFICATION

3.3.1 When the system installation has been completed (or part thereof), perform detailed verification checks for all systems supplied and installed as part of the Work. In the checks and reviews, include the following:

.1 Certify that the equipment has been installed as per the contract documents, and recommended installation procedures, reporting any discrepancies to the Consultant.

.2 Certify that the equipment power and grounding requirements have been satisfied, reporting any discrepancies to the Consultant. For the grounding system, include an itemized check of each instrument circuit to verify the correct isolation of all shields and instrument grounds.

.3 Certify that all terminations to the equipment are properly installed. Report any discrepancies to the Consultant.

.4 Certify that all wiring continuity (whether new or existing) has been verified.

.5 Certify that all process taps, and instrument connections have been performed according to the requirements detailed herein, and shown on the drawings.

.6 Certify that the installation (or part thereof as completed) is ready for commissioning and start-up.

3.3.2 Undertake any corrective action found to be necessary during the verification checkout and review.

3.3.3 Allow for the participation of the Consultant in the verification checks. Any such participation shall not relieve the Contractor of any of the contract obligations.

3.3.4 Prepare the various reports and certificates described herein. Forward three (3) copies of each report and/ or certificate to the Consultant. Clearly identify any discrepancies which require comment on the part of the Consultant.

END OF SECTION

Contract: WWTP UPGRADE 2020

1 GENERAL

1.1 Work Included

1.1.1 Provide demonstration and instruction sessions to familiarize the Owners operation and maintenance personnel with the electrical and control systems, including their operation and maintenance.

1.1.2 Submit system sign off sheets for each system listed prior to substantial completion.

1.1.3 Complete a motor survey sheet for each motor and submit prior to Substantial Completion. Include a control wiring diagram for each motor neatly drawn in ladder form. Indicate all terminal and wire numbers. Identify all associated control components. Provide type-written copies of these lists and diagrams in the Operation & Maintenance manuals. Include motor overload selection charts for each type and application of overload relay.

1.1.4 All sign-off and survey sheets shall be type-written.

1.2 Manufacturer's Site Services

1.2.1 Arrange and pay for appropriately qualified manufacturer's representatives to provide or assist in providing electrical equipment and system demonstration and instruction, as specified herein.

1.3 Contractor/Owner Coordination

1.3.1 The Owner / Engineer will chair demonstration and instruction sessions.

1.3.2 Establish agendas for demonstration and instruction sessions in conjunction with Owner. Coordinate scheduling of sessions with the Owner / Engineer.

2 PRODUCT

2.1 Not Used

2.1.1 Not used.

3 EXECUTION

3.1 Systems Demonstration

3.1.1 Demonstrate operation of following systems:

3.1.2 MCC, Variable Frequency Drives;

3.1.3 New 600V Electrical Distribution equipment;

3.1.4 Mechanical Equipment Connections and Controls;

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 particular 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 In the event that 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 Detailed pipe specifications are provided for each pipe specification code in Section 40 05 13.

.3 Routing: Coordinate piping installation routes and elevations with installation of sheet metal, instrumentation, and electrical work.

.4 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 PVC Piping:

.1 Piping shall be Polyvinyl Chloride (PVC), Schedule 40, Normal Impact, ASTM D1785.

.2 Piping between the disk filters and UV channels shall be Polyvinyl Chloride (PVC), Schedule 80, ASTM D1785.

.3 Fitting shall be PVC, Schedule 40 or Schedule 80 matching the pipe schedule, Normal Impact, Socket Weld, ASTM D2467.

.4 Solvent Cement shall be CPVC, IPS Weld-On 724, ASTM D2855.

.3 Stainless Steel piping:

.1 Piping shall be Stainless Steel (SS), 304L, Material ASTM A312, Fabrication ASTM A778

.2 Fitting shall be flanged, butt welded, ASTM B16.9

.4 Pipe materials and schedules are shown on Drawing P800 – Bill of Materials

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 fibres (Kevlar): ASTM F104 (F712400), and neoprene binder: 1.7 MPa (ASTM F152), 0.2 mL/h Leakage Fuel A (ASTM F37).

.7 Compressed synthetic fibres (Kevlar): ASTM F104 (F712400) and SBR binder: 1.7 MPa (ASTM F152). 0.1 mL/h Leakage Fuel A (ASTM F37).

.8 Gylon - Type 1: Garlock Style 3500. 1.35 MPa (ASTM F152). 0.22 mL/h Leakage Fuel A (ASTM F37).

.9 Gylon - Type 2: Garlock Style 3510. 1.35 MPa (ASTM F152). 0.04 mL/h Leakage Fuel A (ASTM F37).

.10 CPE - Chlorinated Polyethylene.

.3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:

.1 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 meterof 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 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 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.

2.2 BUTTERFLY VALVES

.1 The butterfly valves shall meet the following criteria:

.1 Accepted materials are PVC, CPVC, PVDF
.2 Materials shall be compatible with pipe material
.3 Seat: EPDM

2.3 KNIFE GATE VALVES

.1 The knife gate valves shall meet the following criteria:

.1 Accepted materials are cast iron or ductile body
.2 Stainless steel gate and stem
.3 Buna-N resilient seat
.4 For isolation service, bi-directional tight shutoff

2.4 SWING CHECK VALVES

.1 The swing check valves shall meet the following criteria:

.1 Accepted materials are cast iron or ductile iron
.2 Buna-N flapper with O-ring seating and internally reinforced with steel
.3 Seating surface at 45 degree angle
.4 Replaceable flapper with top cover plate
.5 Epoxy coated

.2 MANUAL GEAR OPERATORS

.1 Manual gear operators shall be sized for the operating rim pull of 80 N at maximum working pressure differential across the valve.
.2 Provide hand lever operator for valves 100 mm and smaller.
.3 Provide geared type actuator complete with valve position indicator for valves 150 mm and larger. Handwheel operator shall be provided unless otherwise specified.

.3 EXTENSION STEM OPERATOR

.1 Provide extension stem, stem guides, 50 mm square AWWA operating nut where shown on the drawings.
.2 Valve extension stem shall be 316 stainless steel c/w stainless steel wall brackets as required for complete installation. The stems shall withstand the maximum operator torques with a safety factor of 1.5.

.4 FLOOR STAND OPERATORS (MANUAL)

.1 Floor stand operators shall be of the enclosed gear pedestal type with top handwheel or side mounted cranks as per the Contract Drawings and shall be sized for the allowable maximum torques for the specified operating pressure across the valve.
.2 Gear ratios shall be selected so that the force exerted on the rim of the crank shall not exceed 180 N. Operator shall be capable of withstanding a force of up to 900 N on the rim without damage. Valve position indicators shall be supplied.
.3 The lift mechanism shall be complete with floor stand, ball thrust bearings, grease fittings, bronze nuts, mounting pedestal and accessories as required.

.4 The operator shall be adaptable to a power wrench operation by replacing the crank with an adapter socket.

.5 Standard pedestal floorstand shall be used unless otherwise specified. Provide offset pedestal floorstand were shown on the drawings.

.6 Provide rising stem floorstand for sluice gates and non-rising stem floorstand for valves.

.7 Provide clear plastic stem cover over the rising stem complete with markings for valve position indication.

.5 ELECTRIC ACTUATORS

.1 The design of electric actuators shall meet the requirements of AWWA C504 latest edition.

.6 SHOP FINISHES

.1 All unfinished iron and steel work on the valves shall be thoroughly cleaned and painted with approved shop coat, refer to Section 09900 Painting. All finished parts shall be coated with heavy grease or a mixture of white lead and tallow to prevent corrosion during shipment and installation. Bronze work shall be left bright.

.7 FIELD PAINTING

.1 All exposed surfaces of valves shall be painted after installation, refer to Section 09900 Painting.

2.5 PIPE SUPPORT

.1 Pipe supports shall be Unistrut-style (posts, bases and clips)

.2 Accepted material: FRP

.3 Refer to Section 40 05 14 for more details.

2.6 EXPANSION JOINTS

.1 Expansion joints are used to compensate for thermal expansion and contraction in the piping system; to isolate equipment from stresses and vibration transmitted from the piping system; and to allow for seismic or long-term settlement which could cause differential movement in adjacent piping or equipment.

.2 Select materials suitable for service commodity, temperature and pressure. Conform to the requirements of the Fluid Sealing Association, Rubber Expansion Joint Division.

.3 Provide control rods on expansion joint connectors to prevent excessive axial elongation and accept the static pressure thrust in the piping system. Manufacturer to determine number and sizes of control rods.

.4 Provide elastomer cover of the same material as the elastomer tube liner.

.1 For service temperatures between 80°C and 120°C use chlorobutyl or EPDM for elastomer tube.

.2 For temperatures below 80°C use EPDM, Neoprene or Buna-N tube elastomer.

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 piping system per NBC and BCBC requirement.

.3 Install all valves and operators in strict accordance with manufacturer's shop drawings and instructions.

.4 Valve floor stands and operators shall be oriented as shown on the drawings.

.5 Install extension stems, stem supports, and other accessories as required and as shown on drawings for the connection of valve operators to floor stand units.

.6 If pipe sleeves through concrete slab for floor stands are not in vertical line with gear operators other than as shown on the drawings, provide universal joints on the extension operating stem for the correction of alignment.

.7 Accurately align pipelines to receive expansion joints before installing the joint. Do not stretch, compress or offset the joint to fit the piping.

.8 Align and install each expansion joint in accordance with EJMA standards and with the manufacturer's written instruction; properly guide and anchor all expansion joints. No lateral movement is permitted on compensator type expansion joints.

.9 On rubber expansion joints, check bolt tightness, and tighten where necessary one week after commissioning and periodically thereafter.

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

PART 1 GENERAL

1.1 DESCRIPTION

1. This section specifies the supply and installation of slide and weir gates indicated on the drawings and as specified hereinafter.

2. Each gate shall have a clear waterway, shall consist of a slide, frame, guides, stem, gate operator and accessories for a complete slide gate assembly as specified.

3. Conform to Division 1 - General Requirements and Division 9 - Finishes.

1.2 SUBMITTALS

1. The Contractor shall submit shop drawings of the gate as follows:

   a) General layout of slide gate and drive with anchor bolt locations.

   b) Details of gate operator assembly and parts list.

   c) Details of gate assembly, accessories and parts list.

   d) Details of stem support assemblies.

   e) Submit installation manuals before shipment of gates.

PART 2 PRODUCTS

2.1 MATERIALS AND DESIGN

1. Each slide gate shall be designed for the specified seating and unseating head and shall be of the highest quality both as to materials and workmanship.
   1. Gates shall be manufactured by Armtec, Fontaine, Dynamic Water Control, or approved equal.

2. The slide gates shall meet the requirements of AWWA C513 – latest edition and meet the leakage requirements as specified herein.

3. All parts of gates shall be amply proportioned for all stresses which may occur during installation and operation.

4. The slide gates shall close by rotation of the stems or handwheels, in a clockwise direction.

5. The slide gates shall have heavy self-supporting frames as noted in the specifications, machined and drilled for bolting to flat surfaces.

6. All anchor bolts and fasteners shall be stainless steel. The stainless steel shall meet the requirement of ASTM A320 GR BB or B8F and ASTM A194 GR 8 or BF.

2.2 REPLACEMENTS

1. Make interchangeable such individual pieces of the equipment herein specified which are furnished alike in each unit. Like pieces shall conform to exact dimensions on the working drawings made by the Manufacturer, so that no fitting or adjustment will be necessary in setting up the entire equipment, other than such as is usually done in high grade standard designed apparatus.

2. It is essential that any defective piece of equipment be easily replaced by a new piece made in accordance with the drawings.

2.3 FRAMES AND GUIDES

1. Provide slide gate frames of ASTM A276, Type 304 stainless steel and come complete with angle frame (SS) and J seals. Gate seals shall be solid neoprene rubber seals (ASTM – D2000).

2. The gate frame shall be of flat back type as shown in the gate schedule, with the frame extended to such height as to retain as least one-half of the vertical height of the slide when the gate is fully open.

3. The gate frame cross section shall be designed to provide a minimum slot width.

4. Gate seat and angle frame shall be an integral unit of structural shapes, assembled by welding to form the waterway opening.

5. Side angles, filler bars and cover bars shall form guides for the slide, and holes shall be provided for mounting on anchor bolts.

2.4 SLIDES

1. Provide slides of ASTM A240, Type 304 stainless steel.

2. Gate slide shall be fabricated from 6 mm minimum thickness plate and reinforced with structural shapes to limit deflection under full head to 1/360 of the span.

3. The slide shall be provided with a stem connection attached by welding, to receive the stem. The pocket shall be capable of taking the full thrust developed during gate operation.

4. Flush bottom seal shall be securely fastened to the bottom cross member of the frame and be removable without disturbing the concrete in the invert of the opening. The top of the seal shall be flush with the invert of the frame. The gate slide should make uniform contact with the top surface of the seal when it is closed and shall not damage the seal surface.

2.5 STEMS

1. Provide the rising type stems of ASTM-A582 stainless steel complete with stem block and guides.

2. The stems shall be designed to withstand, without buckling, the maximum thrust developed by the operating power mechanism or the manually operated handwheel.

3. Provide stem guides of two directional adjustment type, as required so that the unsupported length of any stem does not exceed slenderness ratio (L/r) of 200.

4. Provide removable weatherproof stem guards of transparent plastic.

5. Stem guards shall have the words "Open", "Closed", and the numerals engraved at appropriate locations thereon and a graduated scale. Vent holes shall be provided to prevent condensation.

6. Provide threaded cast zinc aluminum stop nuts on all geared and ball bearing lifts.

7. Hollow type stems are not permitted.

2.6 MANUAL LIFT

1. Provide manual lifting device where specified.

2. Manual lift shall be a floor stand type complete with a side mounted crank with a gear ratio as required for specified operating conditions.

3. For further details on the manual floor stand operators refer to Section 11150 - Process Piping Materials and Methods.

2.7 GATE SCHEDULE

1. The slide gates to be provided are outlined as;

   - SBR 3 splitter box – downward opening weir gates, 2 required

PART 3 EXECUTION

3.1 SHOP FINISHES

1. Thoroughly clean all unfinished steel work of the gate assembly, including guide brackets, collars and paint as specified in Section 09900 - Painting.

2. Coat finished parts with heavy grease or a mixture of white lead and allow to prevent corrosion during shipment and installation.

3. Shop prime other equipment with the appropriate primer specified under Section 09900 - Painting.

3.2 INSTALLATION

1. Test gates to the seating and unseating pressures specified.

2. Test gates for leakage and reduce leakage in amount specified.

3. Protect all exposed apparatus and equipment from mortar drippings, wet concrete or other adhering substances.

4. After installation, clean gates and operators of all foreign matter.

5. Adjust gate and operator to provide smooth operation.

3.3 FIELD PAINTING

1. Field painting of gates, frames and operators is provided under Section 09900.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 Furnish, deliver, and provide installation assistance to:

.1 two submersible pumps for Equalization tank controlled via SBR control panel

.2 The system supplier shall provide installation and start-up assistance training and guarantee the performance. 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.

1.2 SUBMITTALS

.1 Submit required copies of manufacturer's literature, dimensional drawings, wiring diagrams, motor data, performance data, materials of construction, and any other information necessary to determine compliance of the equipment to the specification and project requirements.

.2 Highlight project-specific model numbers and options in equipment data sheets.

.3 Submittal drawings showing plan, elevation, and cross sections of the equipment.

.4 Materials and Manufacturing specifications.

.5 Operation and maintenance manual with installation instructions. Submit after approval of equipment with equipment shipment.

1.3 WARRANTY

.1 Manufacturer shall guarantee all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the data first placed in service, or eighteen (18) months after delivery, whichever occurs first.

1.4 APPROVED MANUFACTURER

.1 The Approved Manufacturer for the submersible pumps is Flygt by Xylem Inc.

.1 Model NP 3153 LT3~623

.2

1.5 INFLUENT WASTEWATER CHARACTERISTICS

.1 The following wastewater parameters are for the entire plant and will be handled by each pump (duty/standby configuration will be implemented).

.2 The following influent parameters are assumed for the design

Average Daily Flow	4,500	m^3/day
Maximum Month Flow	6,000	m^3/day
Peak Dry Weather Flow	5,700	m^3/day
Peak Wet Weather Flow	10,400	m^3/day

1.6 SUBMERSIBLE PUMP DESCRIPTION AND OPERATION

.1 The submersible pumps will be in the Equalization Tank receiving the effluent from the SBR tanks and pumping the liquid to the tertiary filter influent channel.

.2 The submersible pumps will operate in a duty/standby configuration.

.3 The submersible pumps will operate based on EQ tank liquid level and the plant inlet flow meter to match the plant influent and effluent flow rates.

.1 The pumps will operate via VFD drives and will be controlled via SBR control panel.

.2 The SBR control panel will monitor the pump status and fail over to the standby pump in event of a pump failure.

.3 The SBR control panel will provide the necessary hardware to operate the pumps in both automatic and hand mode in event of a SBR PLC fault.

.4 Equalization tank level instrumentation is provided by the project contractor and shall be wired to the SBR control panel. The SBR control system shall allow for input signals from redundant analog level instruments (2 X 4-20mA analog signals) and two discrete input signals (2 x N.O. or N.C. dry contacts)

PART 2 PRODUCTS

2.1 EQUALIZATION TANK PUMPS

.1 Scope of Work

.1 The pump supplier to furnish two submersible non-clog wastewater pumps, for Equalization Tank. Each pump shall be equipped with an appropriately sized submersible electric motor, connected for operation on 575 volts, 3Ø, 60 hertz, three wire power source. The pump is to be provided complete with a sufficient length of submersible cable (SUBCAB) suitable for submersible pump applications to be routed from the pump to a field junction box located in a service accessible location above the equalization tank. In addition to the supply of the pump and cable the pump manufacturer is to supply the field junction boxes, and all required pump thermal and/or seal leak monitoring relays or monitoring devices. The power cable shall be sized according to CEC standards and meet with P-MSHA Approval.

.2 EQ Pump Details:

.1 Flow rate: 13,800 m3/d at 5.0 m static head

.2 Rated power: 11.2 kW

.3 Motor Supply Power: 575V /3Ø /60Hz

.2 Pump Configuration

.1 The pump shall be supplied with a mating cast iron 250 mm discharge connection. The pump(s) shall be automatically and connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with eight meters of lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

.3 Pump Construction

.1 Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be of stainless-steel construction. All metal surfaces meeting the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

.2 Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

.3 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease, or other devices shall be used.

.4 Cooling System

.1 Each unit shall be provided with an integral motor cooling system. A stainless-steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers, or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

.5 Cable Entry Seal

.1 The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist

of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The cable entry unit shall compress the grommets, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary, using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

.6 Motor

.1 The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws, or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

.2 The pump motors are to be VFD driven and shall be compatible with such drive systems.

.3 The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

.4 The motor service factor (combined effect of voltage, frequency, and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

.5 Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of six meters or greater.

.7 Shielded Power Cable - Optional

.1 The power cable shall be sized according to the CEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included, and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of six meters or greater. Cable length shall be field confirmed and be sufficient to allow for neat & orderly routing from the pump to the location of the field junction box.

.8 Bearings

.1 The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two-row angular contact ball bearing to handle radial loads. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

.9 Mechanical Seals

.1 Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to function as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

.2 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

.3 The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

.4 A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

.5 Seal lubricant shall be non-hazardous.

.10 Pump Shaft

.1 The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

.11 Impeller

.1 The impeller shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge, and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt, and shall be coated with alkyd resin primer.

.12 Volute / Suction Cover

.1 The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard-IronTM (ASTM A-532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

.13 Protection

.1 Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

.2 The thermal switches and float switch shall be connected to a Mini CAS control and status monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

.14 Acceptable Manufacturer

.1 Xylem Inc. Flygt Pump NP 3153 LT 3~623

.2

2.2 SEQUENCING BATCH REACTOR AND EQ PUMPS CONTOL SYSTEM

.1 Scope of Work

.1 The SBR supplier to furnish a complete control system. This shall include a master control panel with a Graphic Operator Interface terminal, Programmable Logic Controller, 6 port Ethernet switch, UPS backed AC and DC power supplies, and all require appurtenances.

.2 The control system will be provided with all required field instruments necessary to provide reliable and accurate process control.

.3 Local control stations shall be included for the Decanter, waste sludge pumps and sludge transfer pumps.

.4 Motor Starters and Variable Frequency Drives shall be provided by others and mounted within an MCC in the same room as the SBR Control system is to be mounted. The SBR control system panel will provide dedicated control wiring terminals, for all required monitoring and control signals to be wired between the control panel and the MCC mounted motor control equipment.

.5 The SBR control system shall be sized to provide control of four (4) SBR treatment trains as described in item 1.5.4 of this specification.

.6 The system control panel, field instruments and any vendor supplied wiring systems shall be constructed in compliance with specification sections 01 60 12 Electrical General Requirements and 01 70 12 General Instrumentation Requirements.

PART 3 EXECUTION

3.1 MANUFACTURER'S REPRESENTATIVE

.1 The Contractor shall unload and store the equipment at the site in a suitable fashion, as recommended by the equipment manufacturer. If required, the Contractor shall erect a suitable weather protected enclosure for equipment storage.

.2 The Contractor shall furnish and install equipment anchor bolts per the recommendations of the Equipment Contractor.

.3 The Contractor shall run, and land all required electrical and control wires.

3.2 INSTALLATION

.1 Ensure the equipment is installed as required to provide satisfactory service.

.1 The services of the field representative should be included as needed and described in the equipment submittal.

.2 The Owner shall notify the supplier when the installation of the S EQ Pumps has been completed. A representative of the supplier shall inspect the installation.

The Owner shall be advised in writing of any corrections or adjustments that are required for the EQ Pumps equipment installation. After the EQ Pumps installation has been completed to the supplier's satisfaction, a letter of certification that all equipment is installed in accordance with its instructions and that the EQ pumps and associated equipment is ready for operation shall be furnished.

.2 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installers understanding by completing Form 101 as illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.3 Cooperate with the installer to fulfill the requirements for a successful installation, as documented by Form 102, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.3 TESTING

.1 After installation, and start-up and debugging, the EQ Pumps shall be tested to assure conformance with the performance criteria. The performance criteria include the following:

.1 Maximum flow rate in manual operation

.2 Automatic operation via SBR panel

.2 The Owner reserves the right to evaluate all data from the testing program, and to formulate the final conclusions regarding performance based on the demonstrate system performance.

.3 The EQ Pumps supplier shall make all modifications to the system as required to provide satisfactory operation at no additional cost to the Owner.

.4 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.4 COMMISSIONING

.1 Commissioning is defined as a 30-day period of operation which with the following conditions:

.1 Fully automated operation

.2 Performance criteria achieved

.3 No interruptions due to critical equipment or control system failure or unscheduled maintenance

.2 When commissioning testing are fulfilled, it should be documented by Form 104, illustrated in Section 01 66 20 – Commissioning and Handover.

3.5 POST-COMMISSIONING SERVICES

.1 Provide preventative maintenance services for the first year of operation after the warranty period is completed

.2 Remote services

.1 Provide electrical and mechanical phone support 24 hours per day, 7 days per week, for the period of testing, Start-up, Commissioning, and for the entirety of the performance testing period.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 Furnish, deliver, and provide installation assistance to:

.1 Tertiary Cloth Disk Filter System Package consists of the pile cloth disk filter (PCF)

.2 All equipment specified in the PCF System Package sections shall be supplied as a complete package from one supplier, to unify responsibility for the system warranty, performance, and proper operation.

.3 The system supplier shall provide installation and start-up assistance training and guarantee the performance. Prepare operating and maintenance data as specified in this Section, and as referenced in other pertinent Sections of the Specifications.

.4 Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

.5 Refer to General Conditions re: holdback until complete compliance with the performance of the Work of this Section.

1.2 SUBMITTALS

.1 Submit required copies of manufacturer's literature, dimensional drawings, wiring diagrams, motor data, performance data, materials of construction, and any other information necessary to determine compliance of the equipment to the specification and project requirements.

.2 Highlight project-specific model numbers and options in equipment data sheets.

.3 Submittal drawings showing plan, elevation, and cross sections of the equipment.

.4 Materials and Manufacturing specifications.

.5 Operation and maintenance manual with installation instructions. Submit after approval of equipment with equipment shipment.

1.3 WARRANTY

.1 Manufacturer shall guarantee all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the data first placed in service, or eighteen (18) months after delivery, whichever occurs first.

1.4 APPROVED MANUFACTURER

.1 Nexom

.1 Model NP 3153 LT3~623

.2

1.5 INFLUENT WASTEWATER CHARACTERISTICS

.1 The following wastewater parameters are for the entire plant and will be handled by each pump (duty/standby configuration will be implemented).

.2 The following parameters are to be assumed for the design

Average Daily Flow	4,500	m^3/day
Maximum Month Flow	6,000	m^3/day
Peak Dry Weather Flow	5,700	m^3/day
Peak Hourly Flow	6,900	m^3/day
Filter Inlet TSS	25	mg/L
Filter Outlet TSS	10	mg/L

1.6 PROCESS DESCRIPTION

.1 Clarified wastewater provided within the design conditions enters the tertiary filtration process tanks.

.1 The operator shall be able to bring a drained filter online by simply opening the influent isolation device.

.2 Tertiary cloth disk filters shall be installed as designed by the engineer to operate as required to achieve treatment goals.

.3 The filter system shall minimize mechanical complexity and wear, utilizing filter disks mounted in a rack assembly that provides a continuous supply of filtered water without the interruptions of backwash cleaning cycles.

.4 Only media area below the effluent weir elevation will be considered in the filtration area calculations since this is the only area that is submerged and available for filtration 100% of the time.

.2 As tank level increases, a low-level switch is activated as a run-permissive for the automation of the filter system motors.

.3 The flow pattern shall be such that the disks are fed from outside the disk.

.4 As the water passes from the tank through the cloth material, it enters the core of each disk. Filtrate will be produced when the water level in the tank crests the effluent weir.

.5 Headloss across the filter gradually increases as TSS is captured on the outside surface of the disk media. Headloss provided by a pressure transmitter is compared to a headloss setpoint as a run permissive for a backwash cycle. Once the backwash cleaning system initiates, accumulated TSS is suctioned from the surface of the filter disk, dropping the headloss across the filters. The headloss through the filtration shall not exceed 400 mm under design conditions.

.1 When a backwash cycle is initiated, the drive chain motor rotates the disks, allowing vacuum shoes to clean the active surface area of the PCF disks.

.2 The backwash shoe shall be in direct contact with the cloth to ensure effective media cleaning. Systems utilizing media cleaning mechanisms that do not contact the filter media will not be acceptable.

.3 Backwash pumps are controlled by the PLC in sequence to clean the disks in a filter cell using filtrate produced by the disk filters.

.4 A desludging pump is sequenced automatically by the PLC to desludge the filter cell at an operator adjustable frequency.

.6 A level switch is mounted at the level of the filter tank overflow weir to provide alarm signal for over-capacity events.

.7 Only pile cloth media filters will be allowed.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

.1 One (1) filter tank shall be constructed in concrete by the general contractor per the specifications and drawings.

.1 Filter shall be sized and configured for 100% duty operation.

.2 Filter Access

.1 Filter access platform shall consist of an integral 316 stainless steel catwalk, including anti-slip stainless or FRP grid, providing access to all motors, instruments, and filter media assemblies in the filter tank.

.2 Additional access external to the concrete filter tanks to be provided by the General Contractor per contract drawings.

2.2 FILTER BASIN MOUNTING BRACKETS

.1 Each filter basin shall be fitted with 316 stainless steel mounting brackets to accommodate attachment of the filter components to inside of the basin. All mounting brackets shall be attached to the inside of basin wall with stainless steel anchors by the contractor. Through the wall spool piping and all external piping to the filter shall be provided by the Installing Contractor.

2.3 DRIVE ASSEMBLY

.1 Each filter shall include an adjustable drive assembly with a gearbox, plastic drive sprocket, acetal drive chain with 304 stainless steel link pins. Electric drive motor shall be factory mounted to the filter frame, IP68 submersible type 0.37 kW, 1,410/3.2 RPM, 575 volt, 60htz, 3-phase.

.2 To reduce energy demand, the drive assembly shall rotate the disks only during backwash. Systems requiring constantly rotating disks during filtration will not be acceptable. Belt drive systems or systems with multiple drive units per filter will not be acceptable.

2.4 CENTERTUBE ASSEMBLIES

.1 Each centertube assembly shall include a minimum 316 stainless steel centertube weldment, driven sprocket, wheel assemblies, 316 stainless steel disk segment rods, and composite frame and cloth assemblies. Each centertube assembly shall also include a

Viton v-ring effluent port seal which provides superior chlorine resistance. Materials other than Viton are not acceptable for seal materials. Systems with swivel joints requiring routine replacement are not acceptable. The driven sprocket shall be multi segment made of UHMW polyethylene. All fasteners shall be 316 stainless steel.

.2 Disk inlet ports to centertube shall be spaced no more than 170mm center-to-center.

2.5 CLOTH MEDIA FRAME

.1 Each cloth disk assembly shall be comprised of six (6) individual segments, each consisting of a cloth media sock supported by an injection molded glass filled polypropylene frame with corrosion resistant assembly hardware. Cloth/frame assemblies shall be constructed such that each segment is easily removable from the centertube, without special tools, to allow for removal and replacement of the cloth at the point of installation. Systems requiring special tools or cranes, and/or the return of media segments to the factory for replacement will not be considered.

2.6 FILTER MEDIA

.1 Cloth shall be polyester microfiber pile construction with a nominal filtration rating of 10 microns or less. Granular media, woven media screens and microstrainer type media having structured identical openings shall not be allowed.

.2 Individual pile fibers shall be held in place by a support backing integral to the media. The backing shall be polyester. To facilitate proper flow of backwash water through the cloth, the medium's back side shall be of open construction consisting of 10% open area at least 50 times larger than the nominal filtration media in any direction. Media that uses sewn in support structures, which have the potential to prevent free flow through the media, shall not be allowed.

.3 The cloth media shall have an active filter depth of 3 to 5 mm to provide additional collisions between solid particles and the media within the media depth. Media with less or no filtration depth is not acceptable.

.4 Each complete cloth disk assembly shall have a minimum of 5 square meters of effective submerged filtration area. Each disk shall be divided into no more than six (6) segments and shall be easily removable for service.

.5 If the wet weight of the filter disk segment is greater than 25 kg, the filter supplier shall provide a lifting mechanism.

.6 Each filter basin shall include six cloth disk assemblies. Each filter unit shall have a total of 30 square meters of minimum effective submerged filtration area.

.7 To avoid excessive media movement, deformation and folding during backwash, the maximum distance between cloth restraints must not exceed 1 m.

.8 The pile cloth shall be resistant to free chlorine and/or citric acid cleaning.

2.7 VACUUM SHOES

.1 Vacuum assemblies shall suction filtered solids from both faces of each PCF disk.

.2 Each vacuum shoe shall allow for suction from opposing faces of two disks.

.3 Fabricated vacuum shoes shall be one-piece injection molded plastic to minimize friction and wear on the cloth media.

2.8 BACKWASH/WASTE PUMP

.1 Each filter cell will include two (2) duty backwash pump factory-installed to the filter assembly by the supplier and one (1) duty sludge pump.

.2 Each backwash or waste pump will be an IP X8, submersible Ebara - DWGZ 300 pump with 2.2 kW motor 575 volts, 60htz, 3 phase, or equal.

.3 Designs utilizing backwash pumps and valves external to the filter tank shall not be allowed due to the added construction costs to the owner.

.4 Operator shall have the ability to specify backwash time intervals through the operator interface. The backwash water shall be pressurized by the filter's backwash/waste pump for discharging from the filter system. Systems utilizing non-pressurized backwash flow will not be accepted. Backwash pumps using a belt drive shall not be acceptable due to routine tensioning and other maintenance requirements.

.5 Filtering shall not be interrupted during normal backwashing and solids waste discharge.

2.9 BACKWASH HEADER

.1 Supplier to include a prefabricated backwash header with the filter assembly including a dedicated check valve for each process pump and isolation valves as required to recirculating the tank volume during chemical clean-in-place. The filter supplier supplies all recirculation piping and headers.

2.10 PRESSURE TRANSMITTER

.1 A submersible pressure transducer shall be supplied for each filter basin. The pressure transducer shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 0 psi to 5 psi. Transducers shall be Endress+Hauser FMX21 or approved equal.

2.11 FLOAT SWITCH

.1 A 304 stainless float switch shall be furnished to indicate emerging overflow level. Madison M5600 or approved equal.

2.12 VACUUM SWITCH

.1 A two-position vacuum switch shall be installed on the backwash header and used to alarm for maintenance activities.

2.13 CONTROL SYSTEM

.1 Control Strategy

.1 The disk filter operation shall be managed by an automated control system, the automatic control will be based upon a Programmable Controller.

.2 The filter supplier shall include a control system which shall consist of a programmable controller, fused main disconnect, control transformer, branch circuit breakers, IEC motor starter/protector, and hand-off-automatic switches.

.3 The control panel shall be furnished per the manufacturer's standard design and is not subject to compliance with other control panel specifications.

.4 One (1) 575 VAC, 60 Hz, 3 phase control panel shall be provided to control the filter.

.2 Panel Placement

.1 The control panel will be mounted adjacent to the filter tank or installed in a separate unclassified space and shall be shielded to prevent exposure to direct sunlight if the panel is to be located outdoors.

.2 Unless otherwise specified, the control panel will be isolated from extreme heat, rain, water, ice, humidity, sun, or other properties of weather.

.3 Enclosure

.1 The enclosure shall be a CSA NEMA 12 enclosure with a front panel disconnect suitable for wall mounting.

.4 HMI

.1 The HMI shall be a front door mounted, TFT, color control interface with embedded screen, Allen Bradley PanelView plus 10-inch, or equal

.5 PLC

.1 The PLC shall be an Allen Bradley MicroLogix, or equal.

.6 Painting

.1 Not required on named equipment.

PART 3 EXECUTION

3.1 GENERAL

.1 All equipment specified in the Wastewater Treatment System Package sections shall be installed as a complete package, from one supplier (unless specifically noted otherwise in the specifications), to unify responsibility for the system warranty, performance, and proper operation.

.2 The contractor shall inspect all equipment when received and prior to erection. The contractor shall repair or replace damaged items as directed by the engineer, at no additional cost to the owner.

.3 Equipment and materials shall be delivered, stored, and handled in a manner to ensure installation in a sound and undamaged condition. Sensitive equipment shall be stored in a manner that will prevent exposure to the elements.

3.2 INSTALLATION

.1 The installer of the system shall supply all materials, tools, equipment, and services necessary to install the system.

.2 Install all supplied components in accordance with the manufacturer's instructions and in conformance with submitted shop drawings.

.3 The contractor shall install influent, effluent and reject sampling ports to allow for grab and composite sampling events.

.4 The contractor shall supply all anchor bolts and methods.

.5 Contractor to supply and install all interconnecting pipework between subassemblies.

.6 Contractor to provide interconnecting wiring of all subassemblies described.

.7 The contractor shall install all specified equipment per the manufacturer's installation procedures.

.8 Manufacturer services

.1 The filter manufacturer shall provide up to a total of three (3) trips for startup inspections, controls commissioning, training and performance testing including up to a total of nine (9) eight-hour days onsite service.

.2 The filter manufacturer will prepare a commissioning test plan to be implemented after start-up.

.3 The contractor shall complete the manufacturer's quality assurance documents to validate and verify that installation of the filter modules and specified subcomponents and assemblies are in accordance with drawings and filter manufacturer's installation instructions.

.4 The contractor with the manufacturer's representative present shall start-up and complete functional tests in accordance with manufacturer's instructions.

.5 If defects are revealed during testing, the Engineer may issue instructions for removal or correcting defective work and irregularities. If any material, in whole or in part, does not conform to the Specifications or is found to be defective then such material shall be rejected by the Engineer and replaced.

.9 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installers understanding by completing Form 101 as illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.10 Cooperate with the installer to fulfill the requirements for a successful installation, as documented by Form 102, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.3 PERFORMANCE TESTING

.1 General

.1 All testing shall be performed by the contractor in accordance with the test plan developed by the filter manufacturer and approved by the engineer.

.2 The contractor shall give the engineer two weeks advance notice of the testing to enable the engineer to witness the tests.

.3 The contractor shall conduct and procur all specified tests and shall furnish all power, material, instrumentation, equipment, personnel, etc. for conducting tests as specified herein.

.4 An independent, accredited laboratory shall analyze inlet and outlet samples collected by the contractor over five consecutive days per parameters outlined in these specifications.

.5 The contractor shall submit to the engineer one complete report in PDF format accompanied by analytical data summarized in an electronic spreadsheet file. Report shall include:

.1 Test procedures and operator notes.

.2 Completed logsheets as provided by the filter manufacturer.

.3 Complete analytical reports for all tests, including QA/QC.

.4 Calibration certs of any required instrumentation.

.6 After filter startup, contractor will operate the filter during an acclimation period according to filter manufacturer's instruction for one or more weeks until the filter achieves the effluent limits outlined in these specifications.

.7 Samples will be collected using a time paced automated composite sampler. Grab samples may be used for performance testing if approved by the engineer or owner.

.8 The system will be considered to have passed the performance test if the average outlet concentrations are within specified ranges.

.9 The system will be considered to have failed the performance test if all the inlet parameters are within the ranges specified and the average outlet concentrations exceed those specified.

.10 If the inlet parameters are not within the specified ranges and the average outlet concentrations are outside of specified parameter ranges, this shall not constitute failure. Additional testing with the inlet parameters within the specified ranges may be conducted at the owner's expense and discretion.

.11 If the system fails the performance test, manufacturer will correct any system deficiencies identified in writing and re-test at no additional expense to the owner. No additional payment shall be made for adjustments, modifications, and re-testing.

.2 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.4 COMMISSIONING

.1 Commissioning is defined as a 30-day period of operation which with the following conditions:

.1 Fully automated operation

.2 Performance criteria achieved

.3 No interruptions due to critical equipment or control system failure or unscheduled maintenance

.2 When commissioning testing are fulfilled, it should be documented by Form 104, illustrated in Section 01 66 20 – Commissioning and Handover.

3.5 POST-COMMISSIONING SERVICES

.1 Provide preventative maintenance services for the first year of operation after the warranty period is completed

.2 Remote services

.1 Provide electrical and mechanical phone support 24 hours per day, 7 days per week, for the period of testing, Start-up, Commissioning, and for the entirety of the performance testing period.

END OF SECTION

DISTRICT OF SOOKE

REQUEST FOR TENDER
IFT 2022-004

SUPPLY AND DELIVERY OF WASTEWATER EQUIPMENT INCLUDING: SBR EQUIPMENT

DISTRICT OF SOOKE WWTP UPGRADES 2022

May 13, 2022

The District of Sooke invites qualified Tenders for the supply, delivery, start-up and commissioning of:

- SBR Equipment

and related equipment for incorporation into the District of Sooke WWTP Upgrades 2022 in the District of Sooke, BC. The tender consists of the supply, start-up and commissioning and delivery of equipment and system and accessories as herein specified.

Tenders are scheduled to close at:

Tender Closing Time:	**2:00 p.m. Local Time**
Tender Closing Date:	**Tuesday May 27, 2022** *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: Paul Bohemier, Manager of Waste Water
Tender Enquiries:	Stan Spencer, P.Eng., Stantec Consulting Ltd. Telephone: 250-589-4087 Email: stan.spencer@stantec.com

DISTRICT OF SOOKE

RECEIPT CONFIRMATION FORM

REQUEST FOR TENDER
IFT 2022-004

WWTP EXPANSION
WASTEWATER EQUIPMENT SUPPLY AND DELIVERY

DISTRICT OF SOOKE WWTP UPGRADES 2022

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

.1 The District of Sooke (the "District") invites Tenders from qualified Tenderers for the supply, delivery, start-up, testing and commissioning of:

.1 SBR Equipment

1.2 SCOPE OF SUPPLY AND DESCRIPTION OF GOODS

.1 The supply, delivery, start-up, testing and commissioning of wastewater equipment for incorporation into the District of Sooke WWTP Upgrades 2022 in Sooke, BC. This consists of the following.

.1 Supply of SBR Equipment for municipal wastewater treatment at the Sooke WWTP

.2 Installation support services.

.3 Testing, start-up, training and commissioning support services.

.2 This tender should be read in conjunction with related specifications and drawings as listed above.

.3 Tenders can include all or portion of the Goods.

.4 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"):

Paul Bohemier, Manager of Waste Water
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, May 27, 2022**
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. Electronic submittal is acceptable.

.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 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.

.5 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.

.6 Tenderers are requested to return the enclosed Receipt Confirmation Form within two working days of receipt.

Part 2 Tender Documents

2.1 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: 250.589.4087
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 WASTEWATER 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 WASTEWATER 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 SBR Euqipment summarized in Section 44 42 59 and drawings as part of this Tender package. Additionally provide individual costs of the key SBR Equipment components including: • Aeration components including blower and aeration grid • Mechanical components including decanter mechanism • Control system	1	LS	$	$
				GST (5%) of total	$
				Total	$

(1) The tender assessment is based on the total price for all items related to each equipment package. No claims for lost profit will be allowed from any tenderer if the optional items do not become part of the contract.

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 2023.

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:

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_____, 2022.

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_____, 2022.

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 fall 2022).

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

DISTRICT OF SOOKE

by its authorized signatory on_____day of_____, 2022:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2022:

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 Addenda
.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 the 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 Wastewater 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 (if required), delivery to the Delivery Point of the Goods, testing, commissioning and operations training of the following equipment, as described elsewhere in the Specifications:

.1 SBR Equipment 44 42 59

.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 the 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.

.4 Any or all of the equipment can be provided under a single bid.

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 electronic format or 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 electronic format or 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 either 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 or 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 1 GENERAL

1.1 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.

1.2 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.

1.3 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.

1.4 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 2 PRODUCTS

Not applicable to this Section.

PART 3 EXECUTION

3.1 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.

3.2 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

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, junction boxes, 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 Specification Section 10 70 12 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 International Systems of Units (SI units) shall be the units of measure for all displayed, controlled, and alarmed variables.

1.4 CODES AND STANDARDS

.1 The design and installation of all electrical and instrument systems 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
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)***
NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

.2 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.3 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 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.

1.6 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.

1.7 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.

1.8 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.

1.9 MATERIALS

.1 Equipment shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.10 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.

1.11 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with these specifications.

.2 Equipment and materials shall be CSA certified.

.3 All materials are to be new, free of defects or damage, and of uniform manufacture.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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 discrete: Red for Positive.
Black for Negative.

.7 24 V DC Loop (analog): White for Positive.
Black for Negative.

1.17 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.18 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

PART 2 MATERIALS

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 required 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 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.

.11 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 unless otherwise specified in the packaged equipment specification.

.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 SUPPLY OF VARIABLE FREQUENCY DRIVES

.1 If the packaged equipment specification calls for the supply of VFDs instead of wiring to VFDs supplied by the Contractor, the following clauses apply.

.2 Approved VFD make and model is Rockwell Automation Powerflex 753 or Eaton Power XL. No alternates.

.3 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.

.4 Filters shall be provided on the incoming line and on the load side of the VFD.

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

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

.7 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.

.8 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.

.9 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.

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

.11 The drive enclosure shall meet the requirements of panels and enclosures, detailed within this specification, based on the area to be installed.

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

.13 The drive shall have, as a minimum, circuits within the drive for connection of remote signals via Ethernet I/P 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.

.14 Alarms must be latched in with first-out indication.

.15 The diagnostic system shall monitor each alarm and shutdown function and shall display the status of each point on the front panel interface module.

.16 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;

.17 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.

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

.19 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.

.20 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.

.21 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.

.22 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.

.23 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.

.24 The VFD shall have the capability of being restarted with a remote signal from either the system control panel or the plant PLC/SCADA system.

.25 The VFD shall not be affected by radio frequencies emitted by portable radio transmitters.

.26 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

.27 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.

.28 VFD output faults and short circuit faults shall be manual reset at unit HMI.

.29 Built-in-network communication (Ethernet I/P).

.30 Diagnostics – device, warning, and trip status, time to overload trip, history of last trips, and time to reset.

.31 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.

2.5 ALTERNATE SUPPLY OF MOTOR STARTERS (NON-VFD)

.1 If the packaged equipment specification calls for the supply of motor starters instead of wiring to MCC mounted starters 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 Starters shall as a minimum have ambient temperature compensated thermal overload protective element in each phase, and status wired back to the plant PLC/SCADA control system.

.7 The equipment enclosure shall meet the requirements of panels and enclosures, detailed within this specification, based on the area to be installed.

.8 External reset buttons shall be provided for thermal overload devices.

.9 Overload relays, circuit breakers and contactors shall be sized based on the load requirements.

.10 Include a control station complete with HOA selector switch and indicating devices mounted within sight for all motors.

.11 Provide a red drive running indicator light mounted on the panel or starter.

.12 For reversing motors provide a red (forward) and separate red (reverse) indicating lights mounted on the panel or starter.

.13 Provide a green 'Stop/energized' indicating light mounted on the panel or starter.

.14 Provide, at minimum, hard-wired signals between starters and the package 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 HOR Selected input (Hand and Remote positions to control system)
  - .2 Overload Tripped input (to control system)
  - .3 Running input (two inputs for reversing motors)
  - .4 Run Command output (two outputs for reversing motors).

.15 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.

.16 All power and control wiring to be terminated on terminals in each individual starter cubical or control panel section.

.17 Each starter wiring and schematic diagram located inside control panel door mounted document holder.

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 MOTOR 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 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 a dedicated 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.

2.10 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 Group terminal blocks according to instruments, control and voltage levels.

.8 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.

.9 No more than one wire to be connected to a terminal designated for external wiring.

.10 All terminals are to be numbered in accordance with wiring diagrams.

.11 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.

.12 Provide ferrules on each end of all wires for control.

.13 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.

2.14 WIRE AND CABLE

.1 All conductors to be stranded, 98% conductivity copper, with 600V RW90 XLPE insulation, unless specified below. No aluminum conductor permitted.

.2 Branch Circuit Wiring: conductors smaller than No. 12 AWG not permitted for 120 Volt lighting, power or motor branch circuits.

.3 BX cable is not permitted.

.4 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.

.5 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.

.6 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.

.7 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.

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 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 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).

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 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 Performance Testing.

.2 Details specific to the Commissioning and 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 Assistance and/or witnessing of equipment installation.

.3 Assistance and/or witnessing in equipment/System Demonstration and System Performance Testing and Commissioning.

.4 Assistance and/or witnessing of 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 Performance Testing**: Short term (perhaps 1 hour but maybe less) demonstration or test that shows 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 Performance 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 **Substantial Performance:** Note that all **Forms 104 "Certificate of Satisfactory Commissioning"** are required before the Work is substantially performed.

.8 **Hand Over:** For the purpose of this Work Package, Hand Over will occur on receipt of all completed **"Certificate of Satisfactory Commissioning" (Form 104)** 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.

.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 be in attendance at 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 may 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 may 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 Performance 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 may 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 provide assistance 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 PERFORMANCE TESTING PLAN

.1 Two (2) months prior to commencing System Performance 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 Performance requirements, as defined in the Technical Specifications (e.g. blower air flow, electrical loop validation, etc.). The final plan is to be submitted to the Engineer one (1) month prior to commencement of System Performance 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 Performance 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 Performance Testing.

.3 Methods for disposing of flow required during Performance 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 Performance Testing, indicating their qualifications for this Work.

.6 A checklist of all conditions and operating properties that will be tested through the System Performance 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 required to facilitate testing. Supply all temporary equipment not supplied by the Contractor.

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

1.10 DEMONSTRATION AND SYSTEM PERFORMANCE TESTING TEAM

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

.2 The District will have ultimate authority to stop the System Performance Testing effort. The Contractor will coordinate the System Performance 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 Performance 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 Performance 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 PERFORMANCE TESTING – GENERAL REQUIREMENTS

.1 The Major Equipment will be subjected to one (1) hour Demonstration Test or System Performance Test using clean water and/or wastewater, polymer solution, sludge or air, depending on the System.

.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 (30) days in advance of the expected date of the Demonstration and System Performance 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 SYSTEM AND/OR EUQIPMENT PERFORMANCE TESTING

.1 Prior to the System Performance Test, ensure the following:

.1 Clean water, wastewater, sludge or air, depending on the System, is available for System Performance 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 Performance.

.8 All automated, programmed functions are Performance, 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 Performance Testing process.

.2 Provide the initial charges of oil, grease, and all materials necessary for the System Performance Test all to the satisfaction of the Engineer.

.3 Provide a list of personnel who are planned to be in attendance for the System Performance Test, indicating their qualifications for this Work.

.4 Procedure: Each piece of Major Equipment will be started and operated for about 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.

.1 Demonstrations test should verify minimum, maximum and typical operating conditions with respect to flow rates, pressures, concentrations, velocities, power draw, controls, interlocks, etc.

.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.

.5 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.

.6 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.

3.2 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 one (1) month prior to System Performance Testing.

.2 Draft Operating and Maintenance Manuals must be available from the Supplier at least one (1) month prior to the System Performance Testing.

.3 Control System tested and fully Performance 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.

3.3 SYSTEM PERFORMANCE TESTING

.1 During the System Performance 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 or wastewater, chemicals, temporary power, and any other ancillary services except as indicated, specifically used to conduct System Performance 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 as part of the System Performance Test. During the System Performance 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 results of the one (1) hour Demonstration Test and the System Performance 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.

.6 Should System Performance Testing reveal any defects under the scope of the Work Package, then promptly rectify those defects and repeat the System Performance 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 Performance Test.

.7 Any problems or deficiencies which occur during the System Performance Testing must be rectified before the signing of **“Certificate of Satisfactory System Performance Testing” (Form 103).**

.8 After System Performance Testing, remove any temporary facilities. Completion of this task will be required before signing of **Form 103**.

3.4 VALIDATION OF SUCCESSFUL TESTING

.1 On successful completion of the Demonstration and System Performance 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.

3.5 SYSTEM PERFORMANCE TESTING ACCEPTANCE

.1 An acceptance meeting will be held at the end of the System Performance 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 PERFORMANCE TESTING
FORM 103

We certify that the Major Equipment listed below 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 and Handover 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 technical assistance and supervision to ensure successful equipment operation during the Commissioning period.

.2 During the Commissioning period 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 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 one (1) month to prove compliance with the requirements listed in the Technical Specifications 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" (Form 104)** pre-requisites is required before the Wok is substantially performed.

.6 **Performance Testing (PT):** Equipment will be subjected to Performance Testing, where specified in the Technical Specifications prior to Commissioning.

.7 **Hand Over:** For the purpose of this Work Package, Hand Over will occur on receipt of all completed **Form 104** 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. Refer to Section 01 65 00 for details.

1.4 COMMISSIONING TEAM

.1 For Commissioning Team definition refer to clause 1.3.

.2 The District will have ultimate authority for directing the Performanceaspects of 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 of similar equipment.

1.5 COMMISSIONING PLAN

.1 Through a series of meetings, the Commissioning Team will develop a finalized detailed methodology for the Commissioning of each System at thirty (30) days prior to the planned start of System PerformanceTesting. 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 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.

1.6 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 Performance 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 water or wastewater, chemicals or air, depending on 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 Performance Testing.

.2 Control System tested and fully demonstrated to operate the System through the Plant SCADA system in accordance with Section 01 65 00 – Equipment Installation and Performance Testing.

.3 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.

.4 One (1) month of successful operation to satisfy the requirements of the Commissioning period in accordance with this Section.

.5 Substantial Performance Certificate will be granted upon successful completion of **"Certificate of Satisfactory Commissioning – Phase 1" (Form 104)** documentation.

3.3 COMMISSIONING

.1 Process streams will be introduced to the System by the Commissioning Team in a manner which precludes the damage of any equipment or structures.

.2 During Commissioning, The District will operate the plant according to the design intent and training received with assistance from the Contractor and Supplier as required.

.3 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.

.4 The Contractor, Subcontractor(s) and Supplier(s) must immediately undertake any remedial measures required to ensure operation satisfactory to the Engineer.

.5 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.

.6 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 by the use of available standby equipment.

.7 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.

.1 This means that the equipment or process area may be taken out of service, be operated manually or subjected to anticipated emergency conditions.

.8 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 one (1) month.

.9 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.

.10 After Commissioning, remove any temporary facilities. Completion of this task will be required before signing of **Form 104**.

.11 On successful completion of Commissioning, The District, Engineer and Contractor will sign the **"Certificate of Satisfactory Commissioning" (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.

CERTIFICATE OF SATISFACTORY COMMISSIONING
FORM 104

We certify that the District of Lake Cowichan Water Treatment Facility has been operated, tested and commissioned as per the Contract Documents for at least one (1) month successfully and that the facility and all systems, equipment and components meet their performance criteria, including effluent criteria and fully automatic controls. The treatment equipment and systems are 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)

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 The training session to be provided prior to the System Performance Testing.

.3 Training is required for all equipment and components that comprise the Wastewater Treatment Facility.

.4 Allow at least one and a half (1.5) to seven (7) hours of training 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 Unless specified otherwise, allow for presenting the Training Materials two (2) times during training.

.6 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 and instruction of mechanics, electricians, instrumentation and communications technicians in normal maintenance, including major repairs.

.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 to verify the trainer's qualifications

.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 Subject to each training session, identity the qualifications of individuals to be conducting the training.

.4 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.

.5 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 Treatment Facility.

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. 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.

.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 Performance Testing period defined in Section 01 65 00 – Equipment Installation and Performance 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 Performance 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 Performance Testing period for the following equipment and Systems:

.1 Pre-selected equipment;
.2 Process equipment as specified in Division 40-46
.3 Mechanical Equipment as defined in Divisions 21-27
.4 Electrical equipment as specified in Division 25-27
.5 Instrumentation and control system as defined in Division 25-27

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, building mechanical, electrical, I&C, or other equipment and system in the Project. This introduction will summarize the design intent and the basic sizing and performance 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 performance 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 40-46

.3 Control systems

.4 Electrical equipment (refer to Division 25-27)

.5 Instrumentation (refer to Division 25-27)

.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 Samples of **Forms T1** is attached to this Section.

.3 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

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 International Systems of Units (SI units) shall be the units of measure for all displayed, controlled, and alarmed variables.

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 B16.36	Steel Orifice Flanges
NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

.1 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.2 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 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.

1.6 DOCUMENTATION

.1 Document software and/or annotated 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.

1.7 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.

1.8 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.

1.9 LAYOUT 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.

1.10 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 Setpoint;
.10 Instrument ranges;
.11 Power Supply; and
.12 Calibration range.

1.11 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 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.

.6 Supplier graphics and Control Objects functionality to comply with The Owner's standards (will be provided on request).

1.12 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 All PLC I/O module wiring: Numbered according to I/O point base/slot/point assignments.

1.13 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.

1.14 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.

1.15 ACCEPTABLE MANUFACTURERS

.1 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.

1.16 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.

1.17 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 3 training sessions for operations and maintenance staff. Hands on training to be included in part of each session.

1.18 MATERIALS

.1 Instruments shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.19 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.

1.20 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.

1.21 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 PLC based control system to allow fully automatic unsupervised control of packaged equipment and all ancillary components. Control system must be capable of interfacing with Plant Control System (PCS) via an Ethernet interface.

.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 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
	Negative Pr #2	-	WHT/ORG	White/Orange
Fibre Optic	Jacket		WHT	Orange

2.6 SIGNAL LEVELS

.1 Analog instrument and control device signals shall be 4-20 mA DC with HART protocol.

.2 Analog instrument and control device signals between packaged equipment panels and the plant control system shall be 4-20 mA DC.

.3 It is preferred that all instruments are loop powered when suitable instruments are available. If external power is required, the preference is 24 VDC provided from the vendor control panel.

.4 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.

.5 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).

.6 Solenoids shall be ‘low power’ type, 4 watts or less.

.7 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 Where the device mounting location obscures, or limits operator access to, the transmitter indicator, remote indicators are to be provided. Remote indicators are to be securely mounted using instrument manufactures hardware.

.3 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.

.4 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.

.5 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.

.6 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 PRESSURE

.1 All pressure instruments shall be provided with a 19 mm (¾" NPT) x 12mm (½" NPT) isolation valve.

.2 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.

.3 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.

.4 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. (valve manifolds not required for these applications)

.5 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

.6 Local pressure gauges for process services shall meet ASME B40.100. Further specifications shall be as follows:

.7 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 Movements shall be constructed of stainless steel. Movements shall be of the quadrant and pinion design or the helicoid arm and roller design.
.10 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.
.11 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.
.12 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.
.13 Process gauges for low pressure application shall be as described in the preceding except that they shall have diaphragm sensing elements.
.14 Pressure gauge connections on vessels shall be flanged.
.15 In addition to the piping supplied isolation valve, each pressure gauge shall have a block and bleed calibration valve.

.16 Gauges used in service where pressure spikes and vibration are a concern shall be supplied with pressure snubbers.

2.10 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.

2.11 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.

2.12 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.

2.13 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.

2.14 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.

2.15 INSPECTION AND TESTING

.1 Refer to specification Sections 01 43 00 and 01 45 00 for 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 RESPECTIVE PACAGED EQUPIMENT 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
PLC	Allen-Bradley – ControlLogix L71 RS5000 Version 20.04	Allen Bradley CompactLogix 5380, (small systems only)
Control Valves	As per process specifications	
Automatic On/Off Valves	As per process specifications	
Analysis	Hach	Rosemount, 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 pressure 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)

Description	Preferred	Alternate
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)	Rosemount 8750W, 8712E, ABB, Yokogawa
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	MSA Ultimax XE	Emerson – Net Safety
Combustible Gas Strobe	Killark SHBG-2-23R (C1D1)	
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 WORK INCLUDED

.1 The supply and application of all factory applied prime coats or factory applied finish coats.

1.2 SUBMITTALS

.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

.5 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.

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

PART 1 GENERAL

1.1 GENERAL

.1 Furnish, deliver, and provide installation assistance to a new and complete ICEAS Treatment System, also referred to as the Sequencing Batch Reactor (SBR) system.

.2 The Intermittent Cycle Extended Aeration System (ICEAS) shall include furnishing the necessary equipment and controls to provide an operating treatment system complete with:

- air diffusion equipment
- decant mechanisms
- blower systems with all required air control valves
- waste sludge pumps
- instrumentation
- System control panel and
- Ethernet based software connection to the plant wide SCADA system.

.3 The system supplier shall provide installation and start-up assistance training, and guarantee the process performance. Prepare operating and maintenance data as specified in this Section, and as referenced in other pertinent Sections of the Specifications.

.4 Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

.5 Refer to General Conditions re: holdback until complete compliance with the performance of the Work of this Section.

1.2 SUBMITTALS

.1 Submit required copies of manufacturer's literature, dimensional drawings, wiring diagrams, motor data, performance data, materials of construction, a description of the process design (Operational Description), a description of the control system software logic (Functional Design Specification), and any other information necessary to determine compliance of the equipment to the specification and project requirements.

.2 Submit system control panel drawings complete with details of cabinet interior and exterior layout, complete bill of materials and all panel wiring systems.

.3 Submit detailed information related to electrical motor control (FVNR, FVR and VFD) requirements for each system motor larger than 0.75 Hp. In order to ensure that the

project supplied MCC mounted motor control equipment is of the correct type and size to match each SBR motor application.

.4 Highlight project-specific model numbers and options in equipment data sheets.

.5 Submittal drawings showing plan, elevation and cross sections of the equipment.

.6 Component details of the aeration equipment showing diffusers, diffuser holders, gaskets, retainer rings, supports, threaded union and/or flanged joints and a purge system.

.7 Materials and Manufacturing specifications.

.8 Aeration System submittal information to include:

.1 Equipment data sheets

.2 Performance data including oxygen transfer calculations

.3 Certified SOTE curves from previous test runs on equivalent system shop transfer testing.

.4 Headloss calculations and pressure requirements.

.9 Operation and maintenance manual with installation instructions. Submit after approval of equipment with equipment shipment.

.10 Process Performance Guarantee

1.3 WARRANTY

.1 The requirements of the General and Supplementary Conditions and the requirements as specified hereinafter shall apply.

.2 Manufacturer shall guarantee all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the data first placed in service, or eighteen (18) months after delivery, whichever occurs first.

1.4 APPROVED MANUFACTURER

.1 The Approved Manufacturer for the ICEAS System is Xylem Inc. Sanitaire Products.

.1 ICEAS - Intermittent Cycle Extended Aeration System.

1.5 ICEAS PROCESS DESCRIPTION

.1 The SBR system shall incorporate continuous feed activated sludge technology with intermittent systems operation. The system shall use a single reactor in which the activated sludge is alternately aerated and mixed over a number of pre-determined cycles. Solids liquid separation shall occur during a settling phase of the cycle. After the settling phase, treated effluent shall be decanted or withdrawn from the liquid surface. Flow to the vessel is not interrupted at any time.

.2 The functions of flow equalization, biological oxidation, nitrification, sedimentation and aerobic sludge stabilization shall all be carried out in a single reactor. Systems that require reactor bypassing during the settle and/or decant phases shall not be acceptable.

.3 The Sooke WWTP is currently equipped with two SBR systems. This specification calls for a third SBR system to be incorporated with the existing two SBRs.

.4 The treatment systems new PLC based control panel will service the new SBR basin as well as the two existing SBR basins and one future SBR basin (for a total of 4 SBR basins).

1.6 INFLUENT WASTEWATER CHARACTERISTICS

.1 The following wastewater parameters are for the entire plant and will be handled by the two existing SBRs and the new one.

.2 The following influent parameters are to be assumed for the design

Average Daily Flow	4,500	m^3/day
Maximum Month Flow	6,000	m^3/day
Peak Dry Weather Flow	5,700	m^3/day
Peak Wet Weather Flow	10,400	m^3/day
BOD_5	250	mg/L
TSS	250	mg/L
TKN	45	mg/L
Ammonia NH_3-N	25	mg/L
TP	N/A	mg/L
Temperature Range (Water)	10 - 20	°C
Temperature Range (Air)	-6 - 32	°C
Site Elevation	8	m

1.7 EFFLUENT WASTEWATER REQUIREMENTS

.1 The following effluent parameters are to be assumed for the design based on a 30-day monthly average

BOD_5	20	mg/L
Total Suspended Solids	20	mg/L
Ammonia NH_3-N	N/A	mg/L
Total Nitrogen	N/A	mg/L
Total Phosphorus	N/A	mg/L

1.8 BASIN DIMENSIONS

.1 The new SBR basin dimensions will be identical with the two existing SBR tanks

.2 The existing and the new SBR basin has the following parameters

Width/Basin	10.0	m
Length/Basin	29.3	m
Water Depth at Top Water Level	5.00	m

Water Depth at Bottom Water Level	3.88	m

1.9 SBR BASIN OPERATION

.1 Equally divided influent shall be continuously and simultaneously received by all basins of the ICEAS system at all times, irrespective of the sequence of operation of the treatment system.

.2 The system shall be designed so that the basin configuration prevents short circuiting of the influent during the decant sequence.

.3 A portion of the ICEAS basin reactor shall contain a discrete pre-react zone formed by a baffled wall. This zone shall have an anoxic environment during settle and decant phases.

.4 The multiple ICEAS design should provide the ability to operate with one basin out of service, while maintaining F/M ratios and cell residence time within the endogenous respiratory phase of the biomass. This capability is useful for short time periods such as during basin and equipment maintenance.

PART 2 PRODUCTS

2.1 POSITIVE DISPLACEMENT BLOWERS

.1 Scope of Work

.2 Provide all labor, material and equipment to furnish and install the positive displacement blower systems as specified herein and detailed on the drawings for the SBR basins. The blower systems shall be designed for the following operating characteristics:

	SBR	
Quantity	1	
Air Flow*	1190	Nm^3/h
Discharge Pressure	0.524	bar
Motor Shaft Power	50	HP
Supply Power	600/3/60	V/Φ/Hz
Maximum Average Noise Level**	92	dB
Inlet/Outlet Sizes	6 / 8	mm
Maximum Ambient Temperature	32	°C
Relative Humidity	79	%
Site Elevation	8	m

*measured at 14.7 psia (1 bar), 68°F (20°C) and 36% relative humidity.

**measured at 6 locations at distance of 3 feet from the blower system. Noise level will be measured in a "free-field".

Note that ultimately the SBR system supplier is responsible for verifying that the amount of air required for the system is satisfied with the blower capacity listed here.

.3 Blower and accessories shall be furnished as a complete assembled package and must include all interconnecting piping, instrumentation and supports needed to ship the assembly as a complete unit. The blower packager shall be able to show that similar units have been in successful operation for five years.

.4 Each blower package shall include the following components:

.1 Positive displacement blower
.2 Motor with slide base
.3 V-Belt drive
.4 Flexible expansion joints
.5 Drive guard
.6 Common elevated structural steel base
.7 Inlet filter
.8 Inlet silencer
.9 Discharge silencer
.10 Pressure relief valve
.11 Check valve
.12 Discharge isolation valve
.13 Pressure gauge (discharge)
.14 Pressure gauge (inlet vacuum)
.15 Temperature gauge (discharge)
.16 Vibration isolator pads
.17 Spare parts
.18 Motor Over-temperature Switch

.5 Guarantee and Warranty

.1 Supplier shall warrant all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the date first placed in service, or eighteen (18) months after delivery, whichever occurs first.

.6 Blower Construction

.1 Blower shall be vertically mounted, positive displacement rotary type with top inlet and bottom outlet.
.2 Blower shall be V-belt driven by a motor.
.3 All bearings shall be anti-friction type rated by AFBMA standards to have a B10 life of 60,000 hours at design speed and maximum radial and thrust load conditions.

.7 Blower Casing

.1 Casing shall be made of high grade, close-grained cast iron, annealed for stress relief and heavily ribbed to prevent distortion.

.8 Rotors and Shaft

.1 Each rotor and shaft shall be made of high grade ductile iron, heat treated for stress relief and machined to close tolerances.

.9 Gears and Bearings

.1 Both rotors shall be positively timed by a pair of accurately machined, heat treated ground alloy steel, spur or helical tooth timing gears. The timing gears shall be mounted on the impeller shafts and secured. Each rotor shaft shall be supported by cylindrical roller or ball bearings sized for a minimum of 60,000 hours B10 life.

.10 Lubrication and Seals

.1 The lube oil system shall be supplied with a sight glass and ample reservoir capacity. Provide a lip type oil seal at each bearing, designed to prevent lubricant from leaking into the air stream.

.2 The timing gears and gear end bearings shall be splash oil lubricated from an oil reservoir and slingers mounted on the driven shaft. Drive end bearings shall be grease lubricated.

.11 Base

.1 The blower motor, inlet silencer, discharge silencer, valves and instruments shall be mounted on a common elevated structural steel base of sufficient stiffness to prevent flexing.

.12 Drive System

.1 Each blower shall be driven by a multiple V-belt drive system with a 1.4 service factor. A two-part OSHA approved drive guard shall be provided for each blower.

.13 Motor

.1 Each blower shall be equipped with an electric motor designed, manufactured, and tested in accordance with the latest revised edition of NEMA MG-1. The motor shall be a squirrel-cage induction type, single-speed, horizontally mounted motor conforming to the following:

.1	Synchronous speed:	1800 RPM
.2	Insulation:	Class B or better
.3	Enclosure:	TEFC or ODP
.4	Service factor:	1.15
.5	Duty cycle:	Continuous
.6	Ambient temperature rating:	40 C
.7	Bearing lubrication:	Manufacturer's standard
.8	Bearing life:	50,000 hours rating life as defined by AFBMA Standards
.9	High efficiency design with nominal full load efficiency of 90% minimum.	

.10 Motor windings shall have embedded, normally closed thermal switch that will open upon excessive temperature. The thermal switch will also provide additional external monitoring contacts for connection to the plant SCADA system, these contacts will open in event of a high temperature shutdown condition.

.14 Accessories

.1 Each blower shall be furnished with the following accessory items.
.2 Expansion joint
.3 Intake Filter
.4 Inlet Silencer
.5 Discharge silencers
.6 Pressure Relief Valves
.7 Check Valve
.8 Discharge Butterfly Valve
.9 Vibration Isolator Pads
.10 Inlet Vacuum Gauge
.11 Discharge Pressure Gauge
.12 Discharge Temperature gauge
.13 High temperature shut-down switch

.15 Spare Parts

.1 The equipment supplier shall deliver the following spare parts for each blower size:
.1 One-year supply of oil/grease (under normal operating conditions)
.2 One (1) set of V-belts of each size
.3 One (1) filter element for each size air intake filter
.4 All of the above parts shall be provided as spare parts and shall be packaged for potential long-term dry storage.

.16 Installation, Startup and Training

.1 The blower manufacturer will furnish services of a factory-based engineer for one (1) eight (8) hour day to check the blower installation, make any field adjustments necessary to insure proper mechanical operation, and instruct plant operations personnel on equipment supplied.
.2 The blower manufacturer shall submit a written report for record certifying that equipment has been satisfactorily installed and lubricated. The report shall also certify that training has been provided for operation and maintenance of the blower equipment.
.3 Factory testing - The blower package supplier shall supply a certified ASME PTC-9, Method B performance test data based on a factory 1.0 psi shop test. A certified test report, signed by a registered professional engineer, shall be submitted for record.

.17 Acceptable Manufacturers

.1 Atlas Copco PD Blower

2.2 AIR CONTROL VALVES

.1 Scope of Work

.1 The SBR supplier to furnish all required motor operated air flow control valves to control aeration in the SBR basin.

.1 Actuator power supply: 120/1/60

.2 Actuator type: Open/Close

.2 Construction - Valves

.1 The valves shall be butterfly valves, wafer body style, EPDM-seat, tight-closing type for installation between two (2) ANSI Class 125/150 standard flanges.

.2 The valves shall be rated at 50 psi (345 kPa) and provide drop tight shutoff at differentials up to 50 psi.

.3 Valve bodies shall be cast iron (ASTM A126, Class B) and have two flange bolt guides to center the body in the pipeline. Valves shall be provided with power actuators.

.4 The seat shall be tongue-and-grove design and act as a body liner to prevent flow from contacting the body casting. The seat shall also provide a positive seal without use of flange gaskets. Seats shall be of EPDM suitable for use with compressed air and shall be field replaceable.

.5 The disc shall be aluminum bronze (ASTM B148-954). The disc-to-shaft connections shall be direct drive double "D" design requiring no disc screws or pins to connect shaft to disc. Outside diameter of disc shall be designed that when opened, it will not interfere with adjacent piping.

.6 Shafts shall be one piece and shall be 416 stainless steel (ASTM A582 Type 416). Shafts shall be finish ground to minimize bearing and shaft seal wear. Shaft seals shall be provided to prevent leakage and to protect bearings from internal or external corrosion.

.7 Valves shall be furnished with self-adjusting stem seal and non-corrosive Acetal bushings for smooth, low torque operation.

.3 Construction - Electric Motor Valve Actuators

.1 All electric actuators shall conform to the requirements of AWWA Standard C-540.

.2 Power actuated valves shall be furnished with electric motor actuators. The valve actuators are to be sized for design pressure with flow in reverse direction plus a 1.5 safety factor. The actuators shall include, geared travel limit switches, torque limit switches, manual handwheel, condensation heater, terminals for motor power and controls and drive nut.

.3 The motor shall be specifically designed for actuator service. The motor will be of the induction type with class F insulation and protected by means of thermal switches imbedded in the motor windings. Motor enclosure will be totally enclosed, non-ventilated.

.4 The entire actuator enclosure should be NEMA 4 watertight.

.5 Travel limit switches will be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions. Auxiliary contacts off of these limit switches will be connected to the systems PLC based controls to display valve position status.

.6 Torque limit switches will be connected to the systems PLC based controls to display overtorque alarms.

.7 Mechanical dial position indicator will be furnished on all valves.

.8 The motor shall have an operating speed adjustment.

.4 Acceptable Manufacturers

.1 Valves shall be Bray Series 30 Resilient Seated Butterfly or approved equal.

.2 Actuators shall be AUMA model SG or approved equal.

2.3 FINE BUBBLE AERATION

.1 Scope

.1 Furnish all materials, equipment, services, and testing for the fine bubble aeration system.

.2 Equipment Components included:

.1 Stainless steel droplegs, supports, and anchors.

.2 PVC manifolds, air distributors, diffuser holders, and retainer rings

.3 Bolts, nuts and gaskets for aeration system flange connections.

.4 Air distributor purge systems.

.5 Membrane disc diffusers with integral O-ring gaskets.

.6 Diffuser pressure monitoring systems

.7 Cooling Legs – if required

.3 System Design and Performance

.1 Coordinate with the system and performance requirements listed in 1.5, 1.6, 1.7, 1.8, 1.9, and 2.1.

.2 Design air distributors with centerline spacing not to exceed 4 feet to maximize oxygen transfer efficiency and mixing efficiency and to minimize solids deposition between air distributors.

.4 Materials, Fabrication and Finishing

.1 Stainless Steel - Pipe, Fittings and Supports

.1 Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240, 554, 774, 778.

.2 Fabricate non-welded parts and flanges from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.

.3 Welds & Welding Procedure

.1 Weld in the factory using latest standards according to AWS. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.

.4 Corrosion Protection and Finishing clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:

.1 Preclean outside and finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to

remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.

.2 Natural Rubber - Furnish all fixed and expansion joint O-ring gaskets of natural rubber/SBR with a Shore A durometer of 45 ± 5.

.3 Polyvinyl Chloride (PVC) - Pipe and Fittings

.4 Produce all PVC pipe and fittings from PVC compound with a minimum tensile strength of 48,000kPa.

.1 Provide lower drop pipe, manifold and air distributors as follows:

Diameter	Wall Thickness	ASTM
100 mm	SDR 33.5	D3915, 3034,124524
150 mm & larger	Schedule 40	D1784, D1785, D2466,12454-B

.2 Design air distributors and manifolds to withstand 54° C mean wall temperature.

.3 Add two parts by weight of titanium dioxide per 100 parts of resin to PVC compounds for manifolds, air distributors, joints and PVC diffuser assembly components to minimize ultraviolet light degradation.

.4 Factory solvent weld all PVC joints and fittings. Field solvent welding will NOT be permitted.

.5 EPDM - Membrane Diffusers and Gaskets

.1 Manufacture circular membrane diffuser discs with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (i.e. plasticized PVC or polyurethane) are not acceptable.

.2 Quality Control - Test diffuser using primary sampling criteria outlined in Military Standard 105E.

.6

.5 Fine Bubble Aeration System Components

.1 Droplegs - Provide a stainless steel dropleg from the air main connection to the dropleg connection on the manifold.

.2 Cooling Legs - Provide an extension of stainless steel piping between the dropleg and the manifold to serve as a heat exchanger to cool air prior to contact with the PVC piping, and prevent thermal damage to aeration system – only if required.

.1 Provide heat loss calculations to confirm that cooling leg length is adequate.

.3 Manifolds - Provide PVC manifolds for connection to the air distribution headers.

.1 Fabricate manifolds with 4 inch diameter fixed threaded union positive locking anti rotational or flanged joints for connection to the air distributors.

.4 Air Distributors and Diffuser Holders - 4 inch diameter PVC air distributors perpendicular to the air manifold

.1 Fabricate distributors with single diffuser holders solvent welded to the crown of the air distributor for complete air seal and strength.

.2 Provide 4 inch diameter threaded removable end caps complete with gasket,, threaded coupling and end plate for clean out at the end of each distributor.

.5 Air Distributor and Manifold Connection Joints

.1 Join air distributor sections with positive locking anti rotational fixed threaded union or flange type joints for all submerged header joints to prevent blow apart and rotation.

.2 Design flanged joints with a 56.7 kg drilling angle face ring, follower flange and stainless steel hardware.

.6 Supports- Provide each section of manifold and air distributor with a minimum of two (2) supports.

.1 Limit maximum support spacing to 2.5 meters..

.2 Design all supports to allow for thermal expansion and contraction forces over a temperature range of 52° C and to minimize stress build up in the piping system.

.7 Diffuser Assemblies - Furnish diffuser assemblies including diffuser, diffuser gasket, holder, retaining ring and air flow control orifice.

.1 Membrane Diffuser

.1 Incorporate an integral check valve into the membrane diffuser.

.2 Design and test diffusers for a dynamic wet pressure (DWP) of 12 inches 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.

.3 Visual Uniformity - Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.

.4 Quality Control - Test diffuser using primary sampling criteria outlined in Military Standard 105E.

.8 Diffuser Holders and Retainer Rings

.1 Design holder with air flow control orifice. Holder to provide peripheral support for the diffuser.

.2 Design retainer ring to seal the diffuser and O-ring in the holder to prevent air leakage around gasket.

.3 Design retainer rings threads with minimum cross section of 1/8-inch and allow for one complete turn to engage threads.

.9 Anchor Bolts

.1 Provide a mechanical 304 SS expansion anchor bolts for embedment in 4000 psi concrete with a pullout safety factor of 4.

.10 Liquid Purge System

.1 Provide a liquid purge system to drain the entire submerged aeration piping system for each aeration grid including airlift purge eductor line and control valve. The purge system shall use a solenoid valve for automatic operation coordinated with the SBR operation.

.11 Package spare parts in a separate container clearly marked as "Spare Parts" and provide inventory list on exterior of the container.

.12 Installation Procedures

.1 Follow equipment manufacturer's recommendations and O&M manual for of equipment installation.

.13 Acceptable Manufacturers

.1 Xylem Inc. Sanitaire Products

2.4 DECANT MECHANISM

.1 Scope of Work

.1 The SBR supplier to furnish decanter assemblies with drive actuator for each SBR. The decanters shall be designed to remove clarified effluent

.2 Decanter mechanism details:

.1 Material – 304L SS

.2 Actuator Power Supply – 600V /3Ø /60Hz

.3 Dimensions – as required for the SBR basin size

.2 Design Parameters

.1 The maximum ICEAS decanter loading at Normal Flow Mode condition shall not exceed 20 ft3/ft/min (1.8 m3/m/min). The maximum ICEAS decanter loading at High Flow Mode condition shall not exceed 30 ft3/ft/min (2.8 m3/m/min). The maximum digester decanter loading shall not exceed 35 ft3/ft/min (3.15 m3/m/min).

.2 The maximum headloss through the ICEAS decanter at the peak wet weather flow shall not exceed 0.35 m.

.3 The decanter weir and trough shall always be visible from the basin side wall thereby providing the operator with a visual check of the effluent quality during the decant phase of the cycle.

.4 The decanter shall be parked above the design top water level during aeration and settling phases, thereby eliminating any possibility of solids carryover during these phases. Decanters floating on the liquid surface during aeration and settling, with the weir of entry ports submerged below the surface shall not be allowed.

.5 At top park position, the decanter shall provide 'fail safe' overflow protection in the event of a power failure. Settled supernatant will flow via gravity, under the scum guard, over the weir, and into the decanters.

.6 The decanter shall be designed with a scum guard mechanism to prevent the discharge of scum and floatables during decanter or overflow operation.

.7 All in-basin seals and bearings shall be maintenance free.

.8 Decanter assembly components requiring routine maintenance shall be accessible from the walkway and shall not require confined space entry into the basin.

.9 The drive mechanism or actuator shall be designed for a continuous duty, variable speed mode of operation thereby producing a uniform effluent flow rate throughout the decant phase.

.10 Actuator limit switches and drive motor signal shall be integrated with process control system to prevent blower operation during the decant phase of the cycle.

.11 The decanter assembly shall not require effluent valves, valve vaults, flex joints, throttling capabilities, or dewatering supports.

.3 Equipment

.1 The decanters shall be supplied with the following components:

.1 Upper collection trough with integral, overflow weir

.2 Scum guard mechanism

.3 Downcomer pipes

.4 Collector pipe (for decanters >6ft)

.5 Swivel Joint or Seals & bearings, as required

.6 Electro-mechanical actuator

.2 The drive mechanism or actuator shall consist of an electro-mechanical screw jack with protective boot and end position limit switches. The actuator shall be equipped with a VFD rated motor suitable for continuous duty in an outdoor, moist environment. The motor shall be driven by a variable frequency drive allowing the controls to vertically lower the decanter at a continuous and uniform rate.

.3 The decanter shall not require spring loaded valves, flexible joints, and/or throttling effluent valves to control discharge rate.

.4 The decanter must be self-supporting when the basin is drained.

.4 Controls

.1 Decanters shall be operated per the hydraulic control described in the controls section.

.5 Materials

.1 All in-basin welded decanter components, except seals and bearings, shall be constructed of corrosion and ultra-violet resistant stainless steel. All fasteners shall be constructed of stainless steel.

.2 The decanter seals and bearings shall be constructed of maintenance free, synthetic materials for longest possible service life. All seals and bearings shall be shipped factory assembled, simplifying installation.

.6 Fabrication and Finishing

.1 All decanter welding must be conducted by welders certified under ASME Code 9.

.2 All joints to be finish tested for integrity by either air pressure (3.0 psi) or dye penetrate methods.

.3 All finished decanter units to be fee of abrasions, damage, flaws, carbon contamination and discoloration. All weld burn and discoloration shall be removed with pickle paste. All stainless steel surfaces shall be passivated and shall have a pleasing and uniform passivated appearance. Decanters shall be power washed for final cleaning prior to shipment.

.7 Acceptable Manufacturers

.1 Xylem Inc. Sanitaire Products

2.5 WASTE SLUDGE PUMPS / SLUDGE TRANSFER PUMPS

.1 Scope of Work

.1 The SBR supplier to furnish submersible non-clog wastewater pump(s), in each SBR basin. Leak detectors shall be used to sense water presence in the oil and stator housings, and be complete with all required components to interface these sensors to the system PLC control panel.

.2 WAS Pump Details:

.1 Flow rate: 416 L/min at 5.2m static head

.2 Rated power: 2.4 HP

.3 Motor Supply Power: 600V /3Ø /60Hz

.2 Equipment

.1 Equipment

.1 Each pump shall be equipped with a submersible electric motor with submersible cable (SUBCAB) suitable for submersible pump application. The power cable shall be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron 3-inch discharge connection. Each pump shall be fitted with lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

.2 Pump Design

.1 The pump(s) shall be automatically and firmly connected to the discharge connection, guide by no less than two guide bars extending from the top of the station to discharge connection.

.3 Pump Construction

.1 Major pump components shall be of grey cast iron, ASTM A-48, Class 30B, with smooth surfaces devoid of blow holes or other irregularities.

.2 All O-rings shall be of Nitrile Rubber. The lifting handle shall be stainless steel. Cast iron impellers shall be sprayed with primer.

.4 Bearings

.1 The upper bearing shall be a single row ball bearing. The lower bearing shall be a two row angular contact ball bearing. Motor bearings shall be permanently grease lubricated.

.5 Mechanical Seal

.1 Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies.

.6 Cable Entry Seal

.1 The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable.

.7 Impeller

.1 Impellers available for this pump model shall be either single-vaned, totally enclosed or multi-vaned, vortex type.

.8 Wearing Rings

.1 A wear ring system shall be used to provide efficient sealing between the volute and suction inlet for totally enclosed impellers. Each pump shall be furnished with a leaded red brass ring insert that is drive fitted to the volute inlet.

.9 Volute

.1 Pump volute (s) shall be single-piece grey cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

.10 Acceptable Manufactuers

.1 Xylem Inc. Flygt Products

2.6 SEQUENCING BATCH REACTOR CONTOL SYSTEM

.1 Scope of Work

.1 The SBR supplier to furnish a complete control system. This shall include a master control panel with a Graphic Operator Interface terminal, Programmable Logic Controller, 6 port Ethernet switch, UPS backed AC ad DC power supplies and all require appurtenances.

.2 The control system will be provided with all required field instruments necessary to provide reliable and accurate process control.

.3 Local control stations shall be included for the Decanter, waste sludge pumps and sludge transfer pumps.

.4 Motor Starters and Variable Frequency Drives shall be provided by others and mounted within an MCC in the same room as the SBR Control system is to be mounted. The SBR control system panel will provide dedicated control wiring terminals, for all required monitoring and control signals to be wired between the control panel and the MCC mounted motor control equipment.

.5 The SBR control system shall be sized to provide control of four (4) SBR treatment trains as described in item 1.5.4 of this specification.

.6 The system control panel, field instruments and any vendor supplied wiring systems shall be constructed in compliance with specification sections 01 60 12 Electrical General Requirements and 01 70 12 General Instrumentation Requirements.

.2 Control Panel

.1 The control panel enclosure shall be a heavy duty, NEMA 12, enclosure with a flange mounted disconnect if three-phase power is required. The panel shall be made of 10-gauge steel and fully braced. The doors shall be heavy duty 3-point latching doors with a lockable handle. The master circuit breaker disconnect shall be included, and be interlocked with the doors.

.2 Control power shall be fitted with a voltage filter and surge protective device shall be used for PLC and HMI power supply. The voltage filter will combine active tracking technology with UL listed surge protection against the full spectrum of voltage transients and surges. It must continuously track the input AC line power and respond instantly upon

detecting extraneous high frequency noise and high voltage transients. The device must be UL1449 and UL1283 listed.

.3 All control voltage branch feeders shall be protected by circuit breakers for A/C circuits & and DC Circuits greater than 2A. Fuses may be provided for DC circuits rated at less than 2A

.4 Control relays shall be electromechanical with touch safe screw terminals

.5 Control Terminal blocks shall be medium-density type (no more than two conductors) , rated for 600 VAC, 30 amp minimum. Ten percent spare terminals shall be provided. All devices shall be clearly marked and identified on the inside of the panel. All terminals and wires shall be clearly tagged in accordance with the schematic and wiring diagrams.

.3 Programmable Logic Controller (PLC)

.1 The Programmable Logic Controller (PLC) shall have a built in Ethernet port for network communications.

.2 Acceptable Manufacturers: Rockwell Automation Control Logix series to match the existing Balance of Plant PLC.

.3 Human Machine Interface (HMI)

.4 A Graphic Operator Interface Terminal (HMI) shall be mounted on the front of the panel for control of the SBR as a means of controlling the system and shall provide graphic display of the process parameters and equipment status on a color display. The HMI shall also allow for entry of setpoint changes for system control. The display shall be 15.5" widescreen touchscreen, aspect ratio 16:9. The display shall be connected to a DIN rail mounted industrial computer.

.5 Minimum HMI functions shall include:

.1 Graphical display of all status information available for each device in the biological treatment system in the form of a pop-up window for quick and easy access.

.2 Display all smart sensor status information available from the sensors.

.3 Electronic O&M Manuals for all hardware provided by the SBR manufacturer shall reside on the HMI and be quickly obtained by pushing a button.

.4 Alarm screen that allows the operator to select an alarm and push a button to display troubleshooting tips for that alarm.

.5 Easy navigation set up with control mode select buttons for each basin along the left and HMI screen navigation buttons along the top.

.6 Maintenance dashboard screen with quick read gauges of maintenance life span for all biological treatment devices requiring maintenance.

.7 Historical trend screen displays 10 days of key process variables, logged once per minute, including, where applicable, each basin's DO, Temp, DO Setpoint, Level, Clock, Waste pump running and air valve opened signals.

.8 HMI software shall provide a minimum of one (1) secure client, one (1) web client and one (1) SMA client license for operation staff use.

.9 Acceptable HMI Manufacturers: Rockwell Automation

.4 Remote connection

.1 A webport with a built in six-port Ethernet switch shall be provided to allow direct access for online technical support via a standard internet connection.

.2 A customer account shall be set up by the supplier to allow operations staff access to view the plant HMI via the client licenses using a computer or other portable electronic device.

.5 Control Logic

.1 The SBR controls shall operate on a time cycle basis. The process elapsed time will be displayed on the display terminal. Each pair of SBR tanks will operate on a complimentary basis, so that while one tank is in aeration the other tank is in settling or decant phase. The cycle will automatically adjust for high flow conditions to increase the throughput capacity in high flow conditions. In automatic operation, the processor shall at all times maintain the proper sequence of operation even in the event of power failure. All phases of the process and equipment shall be interlocked so that the process cannot be upset. If an equipment failure takes place an alarm will be displayed on the operator terminal until cleared. The display will indicate the time of the alarm and status.

.2 Time critical sequences and other process variables can be adjusted via the operator interface terminal as follows:

.1 SBR Sequences shall consist of [1] Aeration blower run time, [2] The waste sludge pump start time and running time, [3] The decanter lowering rate, and [4] Special process variables such as DO or SIMS control setpoints if required.

.3 The PLC based control system will include the following major control functions, as well as instruments for monitoring process parameters, as detailed subsequently in this specification:

.1 Hydraulic Control

.2 Decanter Control

.3 Aeration Control

.6 Acceptable control system vendors

.1 Xylem Inc. Sanitaire Products

.2 Instrumentation and process control

.1 Scope of Work

.2 The SBR supplier to furnish, configure and commission the instrumentation for the SBR system. In addition, the SBR supplier shall furnish the PLC based algorithms and instrumentation detailed below to control the process:

.1 Dissolved oxygen sensors

.2 Level transmitter

.3 High level switch or bulb

.3 ICEAS Hydraulic Control

.1 Description of control

.1 The hydraulic control is used to adjust the cycle time to accommodate increased flow events while maintaining treatment objectives.

.2 The hydraulic control shall automatically switch back into a normal mode of operation once the hydraulic threshold has been maintained and an additional cycle has been completed.

.3 The hydraulic control shall interface with the aeration control to increase the settling time to minimum of 30 minutes during the high flow conditions.

.4 Include an integral safety feature interlocking the aeration and mixer controllers to prevent solids carryover in the decanter.

.5 The intent of the multiple modes of operation is to protect the process operation when instrumentation has faulted or is in need of maintenance.

.2 Performance metrics

.1 Submit test data from a minimum of six (6) full-scale plants that demonstrates that the proposed hydraulic control properly transitions to a high-flow cycle when operated continuously at the design peak flow rate, while meeting peak instantaneous NPDES permit levels for grab and composite samples, without water overflowing the basin walls.

.2 For each set of test data submitted, the test shall start at minute 0 of the cycle in the normal cycle, at which time the influent flow rate shall be increased to the peak design flow rate and maintained at that level until the end of the cycle.

.3 For each set of test data submitted, the control system must properly transition to the high-flow cycle, which shall be 75% of the normal cycle periods or less, without water overflowing into the decanter before the start of the decant cycle and without the decanter being submerged at any time.

.4 For each set of test data submitted, measurements of the basin water level during the test, as well as calculations of the hydraulic retention time (HRT) and weir loading rate (CFM/ft) shall be provided.

.3 Instrument specification

.1 Each basin shall be equipped with a level transducer. The level transducer shall have a stainless steel body with a head-pressure-sensing bottom Teflon faced diaphragm and an internal precision, gage pressure transducer assembly. The transducer shall be cable mounted and factory calibrated for the basin depth. The transducer shall be a 2-wire type and produce a 4-20ma signal in direct proportion to the measured level.

.2 The level transducer shall be a Xylem Inc, Flygt Products LTU-40.

.3 Each basin shall be equipped with a high level non-mercury float switch.

.4 The float shall be a Xylem Inc, Flygt Products Model ENM-10.

.5 Level signals and level indication shall be used to control the high flow cycle time and to reduce the aeration time in case of extreme high flows.

.4 Decanter Control

.1 Control description

.1 Decanters shall be used to remove effluent from the SBR basins (and supernate from the digester basins) during the decant phase of the system cycle.

.2 The decanter controller uses an algorithm to descend the decanter weir throughout the cycle at a constant vertical rate ensuring a constant discharge flow rate.

.3 The decanter control ensures proper synchronization between process decant time and weir position prior to the next phase starting to prevent solids contamination in the decanter effluent.

.4 When not at design flow the decanter idle time is at the beginning of the decant cycle to maximize settling time.

.5 Decanter speed will be controlled by a Variable Frequency Drive (VFD) which controls the speed of the decanter actuator motor.

.2 Performance Metrics

.1 Shall ensure the decanter is above the water level prior to aeration of the tank such that solids cannot carryover the decanter 100% of the time during the transition from decant to aeration phase of the cycle.

.3 System Components

.1 Decanter mechanism - as described in mechanical section of this specification

.2 Linear actuator - as described in mechanical section of this specification

.4 VFD

.1 The SBR system vendor shall provide detailed information defining all required VFD sizing and performance characteristics to the engineer as part the submittals defined in Item 1.2.3 of this specification in order to ensure that project supplied (MCC mounted) VFD(s) meet the system performance requirements.

.5 ICEAS Aeration Control

.1 Description of the control

.1 The aeration control is used to reduce energy and optimize process stability by maintaining the desired dissolved oxygen setpoint during aerobic phases of the react phase.

.2 The aeration control algorithm shall switch between modes of operation and make process control adjustments and decisions based on diagnostic information that tests the integrity of the data and utilizes fault indications from the sensors.

.3 The intent of the multiple modes of operation is to protect the process operation when instrumentation has faulted or is in need of maintenance.

.2 Instrumentation specifications

.1 Dissolved Oxygen Probes

.1 Each ICEAS reactor shall be equipped with a dissolved oxygen probe.

.2 Communication to controller shall be digital.

.3 Connection to IQ Sensor Net shall be through two wire shielded cable.

.4 The sensor shall be calibration free using intelligent membrane technology.

.5 Membranes shall last up to two years with replacement membranes containing calibration data chip.

.6 Sensor shall use soft green fluorescent light with calibrated optics and equal path reference system.

.7 Sensor shall have a measuring range of 0-20.00 mg/l.

.8 Sensor shall integrated temperature measurement and compensation.

.9 Temperature operating range of -5° C to + 50° C and measuring range of -5° C to + 50° C.

.10 System accuracy shall be ± 0.05 mg/l < 1.00 mg/l, ± 0.1 mg/l > 1.00 mg/l.

.11 Sensor shall include self-diagnostics.

.12 The DO sensor shall be a YSI/WTW model FDO 700 IQ.

.2 Air Flow Meter

.1 Scope of Supply

.1 The aeration equipment supplier to furnish the insertion mass air flow meters for monitoring and feedback of airflow to the aeration basins.

.2 Installation

.1 The air flow meter shall be mounted such that there is a section of straight pipe a minimum of 10 pipe diameters before the flow element and a minimum of 20 pipe diameters after the flow element. The air flow meter shall be mounted downstream of the air control valve.

.3 Construction - Flow Element

.1 Connection Type: Male NPT Stainless Steel

.2 Type: Insertion Thermal Dispersion

.3 Body Material: 316 Stainless Steel with Adjustable Teflon Ferrule

.4 Sensor Material: Hastelloy C

.5 Temperature Range: 4 to 37 Degree C

.6 Accuracy: +/- 1.0% of upper range value

.7 Pressure Range: 0 to 15 PSIG

.4 Construction - Transmitter

.1 Casing: NEMA 4X Cast Aluminum, Epoxy Coated

.2 Mounting: Remote

.3 Output: 4-20 mA

.4 Display Type: LCD (rate) in engineering units (scfm)

.5 Acceptable Manufacturers

.1 FCI ST50 Series

.3 Scope of Supply

.1 The aeration equipment supplier to furnish the insertion air pressure transmitters for monitoring and feedback of air pressure in the air header.

.2 Type: Force balance or electro-mechanical, two-wire, indicating with a remote diaphragm

.3 Function: Measure a pressure (either absolute, gauge, differential or vacuum) and produce an analog output signal directly proportional to that pressure

.4 Performance Specifications

.1 Range: As shown in Section 2.1.2.

.2 Accuracy: +0.5 percent of the calibrated range

.3 Deadband: +0.075 percent of span maximum

.4 Rangeability: 100:1

.5 Temperature Range: 0-300 degrees F

.6 Output: 4-20mA DC

.4 Required Features:

.1 Positive over-range protection of at least 1.25 times the maximum span limit

.2 Electronic zero and span adjustments

.3 Temperature compensation

.4 Static pressure compensation

.5 Adjustable internal dampening

.6 Field wiring Reversal: Accidental reversal of field wiring shall not damage transmitter

.7 Built-in electrical surge and RFI protection. Also provide an integral transient protection terminal block which meets IEEE standard 587 category B and IEEE standard 472.

.8 Weatherproof and splash proof NEMA 4X enclosure.

.9 ¾-inch NPT electrical conduit connection

.10 Designed to operate on power from receiver or other remote power supply at 24VDC

.11 Integral output digital LCD signal indicator

.12 ½-inch NPT process connection

.5 Materials: Use transmitters constructed of the following materials. Materials shall be suitable for mounting on the blower discharge pipe which will have a temperature of up to 350 degrees F.

.1 Measuring element: Type 316 or 430 Stainless Steel
.2 Flanges: Type 316 or 430 Stainless Steel
.3 Bolts and mounting brackets: type 316 Stainless Steel
.4 Gaskets: Teflon
.5 Base and Cover: Die cast low copper aluminum with epoxy-based finish

.6 Acceptable Manufacturers
.1 ABB Series 2600T
.2 Endress+Hauser Cerabar
.3 Rosemount, Inc., Model 3051C with valve manifold

PART 3 EXECUTION

3.1 MANUFACTURER'S REPRESENTATIVE

.1 The Contractor shall unload and store the equipment at the site in a suitable fashion, as recommended by the equipment manufacturer. If required, the Contractor shall erect a suitable weather protected enclosure for equipment storage.

.2 The Contractor shall furnish and install equipment anchor bolts per the recommendations of the Equipment Contractor.

.3 The Contractor shall run and land all required electrical and control wires.

3.2 INSTALLATION

.1 Ensure the equipment is installed as required to provide satisfactory service.

.1 The services of the field representative should be included as needed and described in the equipment submittal.

.2 The Owner shall notify Sanitaire when the installation of the SBR equipment has been completed. A representative of the supplier shall inspect the installation. The Owner shall be advised in writing of any corrections or adjustments that are required for the SBR equipment installation. After the SBR installation has been completed to the supplier's satisfaction, a letter of certification that all equipment is installed in accordance with its instructions and that the SBR equipment is ready for operation shall be furnished.

.3 A process engineer shall complete operator process training remotely via video conferencing, including review of activated sludge basics and specifics of the biological process, review of the controls description, a discussion of the process control features, instrument calibration and maintenance procedures, and recommend adjustments to process setpoints based on initial plant operating data.

.2 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installers understanding by completing Form 101 as illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.3 Cooperate with the installer to fulfill the requirements for a successful installation, as documented by Form 102, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.4 The SBR system vendor shall provide all required PLC system programming elements in order to allow the owners plant SCADA system to read/write with the SBR PLC for visualization, alarming and trend data collection.

.5 The SBR system vendor shall provide the services of their Control System programmer on site during the testing, commissioning and start-up phases of the work. The programmer will work with both project trades and owner staff to provide services for both testing, commissioning & start-up and co-ordination with the owners plant SCADA system programmer.

3.3 TESTING

.1 After installation, and start-up and debugging, the SBR system shall be tested to assure conformance with the performance criteria. The performance criteria include the following:

.1 Performance parameters and/or field demonstration for each equipment component.

.2 SBR effluent quality as listed in Section 1.7.1.

.2 Supplier shall provide a Process Performance Guarantee to the Owner, guaranteeing the SBR process shall meet effluent wastewater quality, as determined during the Performance Test.

.3 The full Process Performance Guarantee language and details of the Performance Test; defining conditions of guarantee, responsibilities, testing protocol, sampling, and analysis shall be provided with the Equipment Submittal.

.4 The Owner reserves the right to evaluate any and all data from the testing program, and to formulate the final conclusions regarding performance on the basis of the demonstrate system performance.

.5 The SBR supplier shall make any and all modifications to the system as required to provide satisfactory operation at no additional cost to the Owner.

.6 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.4 COMMISSIONING

.1 Commissioning is defined as a 30-day period of operation which with the following conditions:

.1 Fully automated operation

.2 Performance criteria achieved

.3 No interruptions due to critical equipment or control system failure or unscheduled maintenance

.2 When commissioning testing are fulfilled, it should be documented by Form 104, illustrated in Section 01 66 20 – Commissioning and Handover.

3.5 POST-COMMISSIONING SERVICES

.1 Provide preventative maintenance services for the first year of operation after the warranty period is completed

.2 Onsite services

- .1 Provide one site visit during the first year of operation after the warranty period is completed
- .2 Site visits shall consist of one day onsite and be coordinated between the owner and supplier a minimum of ten working days prior to the time that the field services are desired.
- .3 Site visits shall be completed by a qualified biological process engineer experienced in activated sludge processes.
- .4 Site visits shall include the following services:
  - .1 Visual check of bubble patterns in each basin/grid
  - .2 Retrieve and assess on-site pressure monitoring readings
  - .3 Inspect manual purge system in each basin/grid
  - .4 Examine supplied pipework and associated joints - perform leak and level testing [customer must drain basin(s) for this step to be completed]
  - .5 Perform laboratory or field testing of diffuser dynamic wet pressure [customer must drain basin(s) for this step to be completed]
  - .6 Inspection and assessment of supplied instrumentation
  - .7 Refresher process training
  - .8 Review of biological process operating data and effluent requirements
- .5 Upon completion of the onsite inspection a complete written report shall be provided detailing energy and process assessments and recommendations

.3 Remote services

- .1 Provide remote access via modem for PLC/SCADA troubleshooting or programing changes
- .2 Provide a loaner pre-programmed PLC processor and or any I/o modules in the case of PLC hardware failure
- .3 Provide remote process support and troubleshooting including review of operating data and control strategies
- .4 Provide remote reporting modifications and changes
- .5 Provide electrical and mechanical phone support 24 hours per day, 7 days per week, for the period of testing, Start-up, Commissioning, and for the entirety of the performance testing period.

END OF SECTION

DISTRICT OF SOOKE

REQUEST FOR TENDER
IFT 2022-004

SUPPLY AND DELIVERY OF WASTEWATER EQUIPMENT INCLUDING: ROTARY DRUM THICKENER, ROTARY DRUM THICKENER FEED PUMP, POLYMER SYSTEM, AND CONTROL PANEL

DISTRICT OF SOOKE WWTP UPGRADES 2022

April 12, 2022

The District of Sooke invites qualified Tenders for the supply, delivery, start-up and commissioning of:

- Rotary Drum Thickener
- Rotary Drum Thickener Feed Pump
- Polymer System
- Control Panel

and related equipment for incorporation into the District of Sooke WWTP Upgrades 2022 in the District of Sooke, BC. The tender consists of the supply, start-up and commissioning and delivery of equipment and 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:	**Tuesday May 3, 2022** *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: Paul Bohemier, Manager of Waste Water

Tender Enquiries:

Stan Spencer, P.Eng.,
Stantec Consulting Ltd.
Telephone: 250-589-4087
Email: stan.spencer@stantec.com

DISTRICT OF SOOKE

RECEIPT CONFIRMATION FORM

REQUEST FOR TENDER
IFT 2022-004

WWTP EXPANSION
WASTEWATER EQUIPMENT SUPPLY AND DELIVERY

DISTRICT OF SOOKE WWTP UPGRADES 2022

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: _____

Invitation

INVITATION TO TENDER

Part 1

1.1 .1 The District of Sooke (the "District") invites Tenders from qualified Tenderers for the supply, delivery, start-up, testing and commissioning of:

.1 Rotary Drum Thickener
.2 Rotary Drum Thickener Feed Pump
.3 Polymer System
.4 Control Panel for the above items

SCOPE OF SUPPLY AND DESCRIPTION OF GOODS

1.2 .1 The supply, delivery, start-up, testing and commissioning of wastewater equipment for incorporation into the District of Sooke WWTP Upgrades 2022 in Sooke, BC. This consists of the following.

.1 Supply of Rotary Drum Thickener to thicken waste activated sludge from SBR systems
.2 Supply of single Rotary Drum Thickener Feed Pump compatible with the proposed rotary drum thickener.
.3 Supply of a polymer solution preparation and blending system compatible with the proposed rotary drum thickener.
.4 Supply of a single control panel for the above items
.5 Installation support services.
.6 Testing, start-up, training and commissioning support services.

.2 This tender should be read in conjunction with related specifications and drawings as listed above.

1.3 .3 Tenders can include all or portion of the Goods.

.4 Delivery Point: Sooke Waste Treatment Facility, V9Z 0S2.

TENDER SUBMISSION

.1 Tenders will be received at the specified physical location referred to below no later than ("Tender Closing"):

Paul Bohemier, Manager of Waste Water
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, May 3, 2022**
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

2.2 An electronic version of the Tender Documents is available on BC Bid.

The District's language in its procurement documents shall be English.

Part 3

3.1

Tender Enquiries and Addenda

Enquiries should be addressed to the Contact Person:

3.2 Stantec Consulting Ltd.
Stan Spencer, P.Eng.
Telephone: 250.589.4087
Email: stan.spencer@stantec.com

3.3

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.

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.

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.

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,
3.4 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
3.5 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 Contact Person referred to in paragraph 3.1.

3.6

Inspection of Delivery Point

Part 4

The submission of a Tender by the Tenderer shall be deemed to be an acknowledgement that the
4.1 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
5.3 basis for the comparison of tenders. Payment will be based on actual quantities.

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.
Part 6 The applicable Goods and Services Tax (GST) shall be shown as a separate item in the tender price.

6.1

Solicitation

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.

Submission of Tenders

The Tenderer must submit the following completed and executed documentation:

.1 Tender Form Sections 00 20 00, 00 40 00, 00 52 10;

Part 7
7.1 .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.

No oral or electronically transmitted Tenders or amendments to Tenders will be considered.

7.2 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.

7.3 The District will not accept an amendment to a previously submitted Tender unless:

7.4 .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

7.6 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.

7.7 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.

7.8

Tender form must be signed by an authorized signatory of the Tenderer.

Tenderer must acknowledge receipt of all Addenda.

Withdrawal of Tenders

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 8

8.1

Irrevocability of Offer

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.

Part 9

9.1

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.

9.2

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;

10.2

.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.

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.

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.

Acceptance of any Tender may be subject to budgetary considerations and District of Sooke Council approval.

10.3 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
10.4 accept a Tender with some, all or none of such optional items.

10.5

Successful Tenderer Requirements

The successful Tenderer shall execute and deliver the Agreement in the form set out in Sections 00
Part 11 40 00 and 00 52 10, in triplicate, to the District within ten (10) Days after it has received the
11.1 Agreement from the District.

The successful Tenderer shall submit to the District the following original documentation within seven (7) Days of receiving the Notice of Award;

11.2

.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
Part 13 disclose such information, even though it is expressed to be confidential, pursuant to a
13.1 request for information made under that Act. Tenderers are advised to review that Act.

Disclaimers/Limitations of Liability

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.

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.

Novation Agreement

13.2

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.

Part 14

14.1

END OF SECTION

TENDER FORM

Contract: SUPPLY AND DELIVERY OF WASTEWATER 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 WASTEWATER 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 Rotary Drum Thickener summarized in Section 43 71 23 and drawings as part of this Tender package.	1	LS	$	$
2	Supply and delivery of Rotary Drum Thickener Feed Pump summarized in Section 43 25 13 and drawings as part of this Tender package.	1	LS	$	$
3	Supply and delivery of Polymer System package summarized in Section 43 32 69 and drawings as part of this Tender package.	1	LS	$	$
4	Supply and delivery of Control Panel package summarized in Section 43 32 69 and drawings as part of this Tender package.	1	LS	$	$
				GST (5%) of total	$
				Total	$

(1) The tender assessment is based on the total price for all items related to each equipment package. No claims for lost profit will be allowed from any tenderer if the optional items do not become part of the contract.

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 2023.

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:

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_____, 2022.

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_____, 2022.

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 fall 2022).

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

DISTRICT OF SOOKE

by its authorized signatory on_____day of_____, 2022:

SIGNED on behalf of the District by:

Signature: _____

Name: _____

Title: _____

[CONTRACTOR'S NAME]

by its authorized signatory on_____day of_____, 2022:

SIGNED on behalf of the Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

General

DEFINITIONS

.1 The following words and terms, unless the context otherwise requires, in all Contract Documents, shall have the meanings set out below.

Part 1

1.1 "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.

1.2

"Work" means anything and everything required to be done for the fulfilment and completion of this agreement.

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.

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.

1.3 .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

2.1 **District-Supply Contractor Relations**

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

RESPONSIBILITIES OF THE SUPPLY CONTRACTOR

2.2

.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.

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
2.3 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
2.4 authority, on any other contractor.

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.

Specifications and Drawings

INTERPRETATION OF SPECIFICATIONS AND DRAWINGS

Part 3

.1 General

3.1

.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.

Material, Equipment and Workmanship

GENERAL

Part 4

4.1 .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

4.4 .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.

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 the 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.

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. 5.2

.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.

Shipment of Goods/Damage to Goods

SHIPMENT OF GOODS

.1 Delivery of Goods

Part 6

6.1

.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.

Progress and Completion

CONTRACT TIME

.1 Prosecution of the Goods

Part 7
7.1

.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.

TERMINATION

7.2

.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.

Payment

Part 8 **PAYMENTS TO SUPPLY CONTRACTOR**

8.1 .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 Wastewater 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 (if required), delivery to the Delivery Point of the Goods, testing, commissioning and operations training of the following equipment, as described elsewhere in the Specifications:

.1 Rotary Drum Thickener – see Section 44 43 26

.2 Rotary Drum Thickener Feed Pump – see Section 43 25 13

.3 Polymer Feed System – see Section 44 44 36

.4 Control Panel for the above systems – see Section 44 43 26

.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 the 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.

.4 Any or all of the equipment can be provided under a single bid.

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 electronic format or 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 electronic format or 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 either 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 or 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 1 GENERAL

1.1 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.

1.2 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.

1.3 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.

1.4 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 2 PRODUCTS

Not applicable to this Section.

PART 3 EXECUTION

3.1 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.

3.2 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

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, junction boxes, 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 Specification Section 10 70 12 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 International Systems of Units (SI units) shall be the units of measure for all displayed, controlled, and alarmed variables.

1.4 CODES AND STANDARDS

.1 The design and installation of all electrical and instrument systems 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
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)***
NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

.2 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.3 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 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.

1.6 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.

1.7 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.

1.8 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.

1.9 MATERIALS

.1 Equipment shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.10 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.

1.11 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with these specifications.

.2 Equipment and materials shall be CSA certified.

.3 All materials are to be new, free of defects or damage, and of uniform manufacture.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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 discrete: Red for Positive.
Black for Negative.

.7 24 V DC Loop (analog): White for Positive.
Black for Negative.

1.17 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.18 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

PART 2 MATERIALS

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 required 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 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.

.11 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 unless otherwise specified in the packaged equipment specification.

.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 SUPPLY OF VARIABLE FREQUENCY DRIVES

.1 If the packaged equipment specification calls for the supply of VFDs instead of wiring to VFDs supplied by the Contractor, the following clauses apply.

.2 Approved VFD make and model is Rockwell Automation Powerflex 753 or Eaton Power XL. No alternates.

.3 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.

.4 Filters shall be provided on the incoming line and on the load side of the VFD.

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

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

.7 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.

.8 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.

.9 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.

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

.11 The drive enclosure shall meet the requirements of panels and enclosures, detailed within this specification, based on the area to be installed.

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

.13 The drive shall have, as a minimum, circuits within the drive for connection of remote signals via Ethernet I/P 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.

.14 Alarms must be latched in with first-out indication.

.15 The diagnostic system shall monitor each alarm and shutdown function and shall display the status of each point on the front panel interface module.

.16 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;

.17 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.

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

.19 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.

.20 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.

.21 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.

.22 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.

.23 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.

.24 The VFD shall have the capability of being restarted with a remote signal from either the system control panel or the plant PLC/SCADA system.

.25 The VFD shall not be affected by radio frequencies emitted by portable radio transmitters.

.26 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

.27 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.

.28 VFD output faults and short circuit faults shall be manual reset at unit HMI.

.29 Built-in-network communication (Ethernet I/P).

.30 Diagnostics – device, warning, and trip status, time to overload trip, history of last trips, and time to reset.

.31 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.

2.5 ALTERNATE SUPPLY OF MOTOR STARTERS (NON-VFD)

.1 If the packaged equipment specification calls for the supply of motor starters instead of wiring to MCC mounted starters 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 Starters shall as a minimum have ambient temperature compensated thermal overload protective element in each phase, and status wired back to the plant PLC/SCADA control system.

.7 The equipment enclosure shall meet the requirements of panels and enclosures, detailed within this specification, based on the area to be installed.

.8 External reset buttons shall be provided for thermal overload devices.

.9 Overload relays, circuit breakers and contactors shall be sized based on the load requirements.

.10 Include a control station complete with HOA selector switch and indicating devices mounted within sight for all motors.

.11 Provide a red drive running indicator light mounted on the panel or starter.

.12 For reversing motors provide a red (forward) and separate red (reverse) indicating lights mounted on the panel or starter.

.13 Provide a green 'Stop/energized' indicating light mounted on the panel or starter.

.14 Provide, at minimum, hard-wired signals between starters and the package 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 HOR Selected input (Hand and Remote positions to control system)
  - .2 Overload Tripped input (to control system)
  - .3 Running input (two inputs for reversing motors)
  - .4 Run Command output (two outputs for reversing motors).

.15 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.

.16 All power and control wiring to be terminated on terminals in each individual starter cubical or control panel section.

.17 Each starter wiring and schematic diagram located inside control panel door mounted document holder.

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 MOTOR 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 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 a dedicated 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.

2.10 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 Group terminal blocks according to instruments, control and voltage levels.

.8 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.

.9 No more than one wire to be connected to a terminal designated for external wiring.

.10 All terminals are to be numbered in accordance with wiring diagrams.

.11 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.

.12 Provide ferrules on each end of all wires for control.

.13 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.

2.14 WIRE AND CABLE

.1 All conductors to be stranded, 98% conductivity copper, with 600V RW90 XLPE insulation, unless specified below. No aluminum conductor permitted.

.2 Branch Circuit Wiring: conductors smaller than No. 12 AWG not permitted for 120 Volt lighting, power or motor branch circuits.

.3 BX cable is not permitted.

.4 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.

.5 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.

.6 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.

.7 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.

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 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 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).

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 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 Performance Testing.

.2 Details specific to the Commissioning and 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 Assistance and/or witnessing of equipment installation.

.3 Assistance and/or witnessing in equipment/System Demonstration and System Performance Testing and Commissioning.

.4 Assistance and/or witnessing of 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 Performance Testing**: Short term (perhaps 1 hour but maybe less) demonstration or test that shows 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 Performance 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 **Substantial Performance:** Note that all **Forms 104 "Certificate of Satisfactory Commissioning"** are required before the Work is substantially performed.

.8 **Hand Over:** For the purpose of this Work Package, Hand Over will occur on receipt of all completed **"Certificate of Satisfactory Commissioning" (Form 104)** 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.

.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 be in attendance at 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 may 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 may 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 Performance 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 may 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 provide assistance 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 PERFORMANCE TESTING PLAN

.1 Two (2) months prior to commencing System Performance 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 Performance requirements, as defined in the Technical Specifications (e.g. blower air flow, electrical loop validation, etc.). The final plan is to be submitted to the Engineer one (1) month prior to commencement of System Performance 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 Performance 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 Performance Testing.

.3 Methods for disposing of flow required during Performance 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 Performance Testing, indicating their qualifications for this Work.

.6 A checklist of all conditions and operating properties that will be tested through the System Performance 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 required to facilitate testing. Supply all temporary equipment not supplied by the Contractor.

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

1.10 DEMONSTRATION AND SYSTEM PERFORMANCE TESTING TEAM

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

.2 The District will have ultimate authority to stop the System Performance Testing effort. The Contractor will coordinate the System Performance 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 Performance 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 Performance 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 PERFORMANCE TESTING – GENERAL REQUIREMENTS

.1 The Major Equipment will be subjected to one (1) hour Demonstration Test or System Performance Test using clean water and/or wastewater, polymer solution, sludge or air, depending on the System.

.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 (30) days in advance of the expected date of the Demonstration and System Performance 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 SYSTEM AND/OR EUQIPMENT PERFORMANCE TESTING

.1 Prior to the System Performance Test, ensure the following:

.1 Clean water, wastewater, sludge or air, depending on the System, is available for System Performance 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 Performance.

.8 All automated, programmed functions are Performance, 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 Performance Testing process.

.2 Provide the initial charges of oil, grease, and all materials necessary for the System Performance Test all to the satisfaction of the Engineer.

.3 Provide a list of personnel who are planned to be in attendance for the System Performance Test, indicating their qualifications for this Work.

.4 Procedure: Each piece of Major Equipment will be started and operated for about 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.

.1 Demonstrations test should verify minimum, maximum and typical operating conditions with respect to flow rates, pressures, concentrations, velocities, power draw, controls, interlocks, etc.

.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.

.5 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.

.6 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.

3.2 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 one (1) month prior to System Performance Testing.

.2 Draft Operating and Maintenance Manuals must be available from the Supplier at least one (1) month prior to the System Performance Testing.

.3 Control System tested and fully Performance 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.

3.3 SYSTEM PERFORMANCE TESTING

.1 During the System Performance 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 or wastewater, chemicals, temporary power, and any other ancillary services except as indicated, specifically used to conduct System Performance 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 as part of the System Performance Test. During the System Performance 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 results of the one (1) hour Demonstration Test and the System Performance 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.

.6 Should System Performance Testing reveal any defects under the scope of the Work Package, then promptly rectify those defects and repeat the System Performance 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 Performance Test.

.7 Any problems or deficiencies which occur during the System Performance Testing must be rectified before the signing of **“Certificate of Satisfactory System Performance Testing” (Form 103).**

.8 After System Performance Testing, remove any temporary facilities. Completion of this task will be required before signing of **Form 103**.

3.4 VALIDATION OF SUCCESSFUL TESTING

.1 On successful completion of the Demonstration and System Performance 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.

3.5 SYSTEM PERFORMANCE TESTING ACCEPTANCE

.1 An acceptance meeting will be held at the end of the System Performance 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 PERFORMANCE TESTING
FORM 103

We certify that the Major Equipment listed below 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 and Handover 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 technical assistance and supervision to ensure successful equipment operation during the Commissioning period.

.2 During the Commissioning period 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 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 one (1) month to prove compliance with the requirements listed in the Technical Specifications 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" (Form 104)** pre-requisites is required before the Wok is substantially performed.

.6 **Performance Testing (PT):** Equipment will be subjected to Performance Testing, where specified in the Technical Specifications prior to Commissioning.

.7 **Hand Over:** For the purpose of this Work Package, Hand Over will occur on receipt of all completed **Form 104** 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. Refer to Section 01 65 00 for details.

1.4 COMMISSIONING TEAM

.1 For Commissioning Team definition refer to clause 1.3.

.2 The District will have ultimate authority for directing the Performanceaspects of 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 of similar equipment.

1.5 COMMISSIONING PLAN

.1 Through a series of meetings, the Commissioning Team will develop a finalized detailed methodology for the Commissioning of each System at thirty (30) days prior to the planned start of System PerformanceTesting. 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 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.

1.6 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 Performance 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 water or wastewater, chemicals or air, depending on 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 Performance Testing.

.2 Control System tested and fully demonstrated to operate the System through the Plant SCADA system in accordance with Section 01 65 00 – Equipment Installation and Performance Testing.

.3 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.

.4 One (1) month of successful operation to satisfy the requirements of the Commissioning period in accordance with this Section.

.5 Substantial Performance Certificate will be granted upon successful completion of **"Certificate of Satisfactory Commissioning – Phase 1" (Form 104)** documentation.

3.3 COMMISSIONING

.1 Process streams will be introduced to the System by the Commissioning Team in a manner which precludes the damage of any equipment or structures.

.2 During Commissioning, The District will operate the plant according to the design intent and training received with assistance from the Contractor and Supplier as required.

.3 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.

.4 The Contractor, Subcontractor(s) and Supplier(s) must immediately undertake any remedial measures required to ensure operation satisfactory to the Engineer.

.5 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.

.6 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 by the use of available standby equipment.

.7 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.

.1 This means that the equipment or process area may be taken out of service, be operated manually or subjected to anticipated emergency conditions.

.8 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 one (1) month.

.9 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.

.10 After Commissioning, remove any temporary facilities. Completion of this task will be required before signing of **Form 104**.

.11 On successful completion of Commissioning, The District, Engineer and Contractor will sign the **"Certificate of Satisfactory Commissioning" (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.

CERTIFICATE OF SATISFACTORY COMMISSIONING
FORM 104

We certify that the District of Lake Cowichan Water Treatment Facility has been operated, tested and commissioned as per the Contract Documents for at least one (1) month successfully and that the facility and all systems, equipment and components meet their performance criteria, including effluent criteria and fully automatic controls. The treatment equipment and systems are 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)

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 The training session to be provided prior to the System Performance Testing.

.3 Training is required for all equipment and components that comprise the Wastewater Treatment Facility.

.4 Allow at least one and a half (1.5) to seven (7) hours of training 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 Unless specified otherwise, allow for presenting the Training Materials two (2) times during training.

.6 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 and instruction of mechanics, electricians, instrumentation and communications technicians in normal maintenance, including major repairs.

.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 to verify the trainer's qualifications

.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 Subject to each training session, identity the qualifications of individuals to be conducting the training.

.4 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.

.5 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 Treatment Facility.

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. 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.

.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 Performance Testing period defined in Section 01 65 00 – Equipment Installation and Performance 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 Performance 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 Performance Testing period for the following equipment and Systems:

.1 Pre-selected equipment;
.2 Process equipment as specified in Division 40-46
.3 Mechanical Equipment as defined in Divisions 21-27
.4 Electrical equipment as specified in Division 25-27
.5 Instrumentation and control system as defined in Division 25-27

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, building mechanical, electrical, I&C, or other equipment and system in the Project. This introduction will summarize the design intent and the basic sizing and performance 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 performance 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 40-46

.3 Control systems

.4 Electrical equipment (refer to Division 25-27)

.5 Instrumentation (refer to Division 25-27)

.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 Samples of **Forms T1** is attached to this Section.

.3 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

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 International Systems of Units (SI units) shall be the units of measure for all displayed, controlled, and alarmed variables.

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 B16.36	Steel Orifice Flanges
NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

.1 In the absence of a specific standard, the original manufacturer's recommendations will prevail subject to approval by the Engineer.

.2 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 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.

1.6 DOCUMENTATION

.1 Document software and/or annotated 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.

1.7 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.

1.8 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.

1.9 LAYOUT 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.

1.10 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 Setpoint;
.10 Instrument ranges;
.11 Power Supply; and
.12 Calibration range.

1.11 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 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.

.6 Supplier graphics and Control Objects functionality to comply with The Owner's standards (will be provided on request).

1.12 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 All PLC I/O module wiring: Numbered according to I/O point base/slot/point assignments.

1.13 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.

1.14 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.

1.15 ACCEPTABLE MANUFACTURERS

.1 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.

1.16 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.

1.17 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 3 training sessions for operations and maintenance staff. Hands on training to be included in part of each session.

1.18 MATERIALS

.1 Instruments shall be manufactured of material suitable for the process and atmospheric conditions specified in the Packaged Equipment specification and data sheets.

1.19 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.

1.20 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.

1.21 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 PLC based control system to allow fully automatic unsupervised control of packaged equipment and all ancillary components. Control system must be capable of interfacing with Plant Control System (PCS) via an Ethernet interface.

.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 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
	Negative Pr #2	-	WHT/ORG	White/Orange
Fibre Optic	Jacket		WHT	Orange

2.6 SIGNAL LEVELS

.1 Analog instrument and control device signals shall be 4-20 mA DC with HART protocol.

.2 Analog instrument and control device signals between packaged equipment panels and the plant control system shall be 4-20 mA DC.

.3 It is preferred that all instruments are loop powered when suitable instruments are available. If external power is required, the preference is 24 VDC provided from the vendor control panel.

.4 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.

.5 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).

.6 Solenoids shall be ‘low power’ type, 4 watts or less.

.7 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 Where the device mounting location obscures, or limits operator access to, the transmitter indicator, remote indicators are to be provided. Remote indicators are to be securely mounted using instrument manufactures hardware.

.3 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.

.4 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.

.5 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.

.6 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 PRESSURE

.1 All pressure instruments shall be provided with a 19 mm (¾" NPT) x 12mm (½" NPT) isolation valve.

.2 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.

.3 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.

.4 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. (valve manifolds not required for these applications)

.5 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

.6 Local pressure gauges for process services shall meet ASME B40.100. Further specifications shall be as follows:

.7 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 Movements shall be constructed of stainless steel. Movements shall be of the quadrant and pinion design or the helicoid arm and roller design.
.10 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.
.11 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.
.12 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.
.13 Process gauges for low pressure application shall be as described in the preceding except that they shall have diaphragm sensing elements.
.14 Pressure gauge connections on vessels shall be flanged.
.15 In addition to the piping supplied isolation valve, each pressure gauge shall have a block and bleed calibration valve.

.16 Gauges used in service where pressure spikes and vibration are a concern shall be supplied with pressure snubbers.

2.10 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.

2.11 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.

2.12 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.

2.13 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.

2.14 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.

2.15 INSPECTION AND TESTING

.1 Refer to specification Sections 01 43 00 and 01 45 00 for 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 RESPECTIVE PACAGED EQUPIMENT 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
PLC	Allen-Bradley – ControlLogix L71 RS5000 Version 20.04	Allen Bradley CompactLogix 5380, (small systems only)
Control Valves	As per process specifications	
Automatic On/Off Valves	As per process specifications	
Analysis	Hach	Rosemount, 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 pressure 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)

Description	Preferred	Alternate
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)	Rosemount 8750W, 8712E, ABB, Yokogawa
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	MSA Ultimax XE	Emerson – Net Safety
Combustible Gas Strobe	Killark SHBG-2-23R (C1D1)	
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 WORK INCLUDED

.1 The supply and application of all factory applied prime coats or factory applied finish coats.

1.2 SUBMITTALS

.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

.5 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.

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

PART 1 GENERAL

1.1 DESCRIPTION

.1 This Section specifies the supply, testing and commissioning of all necessary equipment and controls for:

.1 Thin Sludge Feed Pump to Rotary Drum Thickener

.2 All other access equipment and appurtenances necessary for a complete and operational system

.2 The Thin Sludge Feed Pump is intended to transfer sludge from the WAS Equalization Tank to the Rotary Drum Thickener

.3 The pump is intended to operate automatically and be fully integrated in the existing plant infrastructure. The feed pump will be controlled automatically via Rotary Drum Thickener Control Panel.

.4 The pump shall be suitable for being driven by a variable frequency drive (VFD) to be located in the project supplied MCC in the electrical room.

.5 The Contractor will provide system installation under the Supplier guidance and will provide support during testing and commissioning.

1.2 SUBMITTALS

.1 Shop Drawings: Submit in accordance with Section 01 30 00 - Submittals, include the following:

.1 Certified shop showing all important details of construction, dimensions.

.2 Complete Bill of Materials

.3 Descriptive literature, bulletins and/or catalogs of the equipment.

.4 Ancillary equipment performance information.

.5 Furnish all information required in shop drawing submittal requirements.

.6 The total weight of the equipment, including the weight of the single largest item.

.7 A list of the manufacturer's recommended spare parts.

.2 Complete assembly and installation drawings, together with detailed specifications and data covering material used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section. The data and specifications for each unit shall include, but not be limited to, the following:

1. Type, manufacturer and general description,
2. General outline drawings showing clearly all general and essential dimensions.
3. Descriptions and specifications of various components including:
   a. Pump impeller
   b. Pump casing
   c. Wearing rings
   d. Discharge fittings

e. Accessories.

4. Pump characteristic curves showing efficiency, power requirements, pump capacities at various heads, curve number, impeller diameter, rated speed. A set of pump curves operating at various speeds shall be provided for the pumps to be driven by a VFD.
5. Data as follows:
   a. power requirements, voltage, motor power output
   b. total mass of pump and motor
   c. level controls
   d. pump controls.
6. Required ancillary services including, but not limited to, electrical, seal water, and drains. The sizes, ratings, and other pertinent information related to these services.
7. Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances, and points of connection for ancillary services (electrical, seal water, drains, etc.).
8. Electrical connection diagrams and ladder type schematics, identifying all items requiring electrical control or power for operation of the equipment, shall be submitted for review. Submittals shall verify each applicable feature in this Specification. All schematics shall number each wire and terminal to coincide with the assembled equipment. Each contact, timer and related items shall be labeled to coincide with the equipment installed in the Rotary Drum Thickener local control panel and on the equipment. The schematics shall be supplemented by a narrative detailing equipment start-up and shutdown functions as they relate to the electrical devices.
9. The drawings shall indicate the conduit and wiring requirements between the Rotary Drum Thickener local control panel, the MCC mounted VFD, and the Feed Pump itself.
10. Start-up instructions including lubricant requirements, electrical requirements, etc.
11. Operating and Maintenance Data: Provide for incorporation into operation and maintenance manual. Include complete description of operation together with general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogues with complete list of repair and replacement parts with section drawings, illustrating the connections and the part manufacturer's identifying numbers.

1.3 COORDINATION

.1 Coordinate with other Divisions to ensure there are no conflict in the work.

1.4 STANDARDS

1.5 Products provided under this specification must comply with all regulations and codes in effect in British Columbia.

1.6 Electrical work shall be in accordance with the Canadian Electrical Code and with applicable standards of the Electrical and Electronic Manufacturers Association of Canada (EEMAC) and the Canadian Standards Association (CSA).

1.7 Hydraulic Efficiency and Pump Impeller tolerances shall conform to the Standards of the Hydraulic Institute.

1.8 SHIPMENT PROTECTION AND STORAGE

.1 Ship pre-assembled to the degree that is possible.

.2 Provide storage instructions indicating specific requirements to ensure there is no uneven wear, distortion, or weathering of components.

.3 Identify all other special storage requirements.

1.9 MANUFACTURER

.1 The submersible pump 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 design is based on Xylem (ITT-Flygt pumps).

.1 Alternative manufacturers include KSB, Pumpex, ABS/Sulzer, and other engineer approved products.

PART 2 PRODUCTS

2.1 DESCRIPTION

.1 The pump systems shall include the supply and installation of the specified submersible pumps and shall include the following accessories:

.1 cast iron discharge elbows
.2 lifting guide rails (stainless steel)
.3 guide rail supports (stainless steel)
.4 anchor bolts (stainless steel)
.5 pump lifting chains (stainless steel)
.6 lifting davit and hoist
.7 Flygt control & status (CAS) monitoring unit or approved alternative.

2.2 DESIGN CONDITIONS

.1 Sludge Feed Pump

Parameter	Value
Average daily sludge volume	136 m3/d
Typical sludge concentration	0.8% TS
Sludge composition	PS + WAS
Operation	Continuous or intermittent on demand
Pump location	Sludge EQ Tank; submerged
Static Head	7.5 m
Power	575/3/60
Drive Type	VFD
Controls	Via RDT Control Panel

2.3 MATERIALS

.1 Pump Construction

.1 The pump shall be a submersible, non-clog, solids handling type with cast-iron vane impeller conforming to ASTM A-278.

.2 Pump volute, motor and seal housing to be high quality cast-iron conforming to ASTM A-278.

.3 All external mating parts to be machined and sealed with O-rings.

.4 All fasteners or hardware including the motor nameplate exposed to the pumped liquid shall be stainless steel. Pump and motor shaft shall be stainless steel, one piece.

.5 Pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. The rotating seal surfaces to be carbon and the stationary seal faces to be ceramic. The outboard seal next to the impeller shall be provided with tungsten carbide faces. Provide removable inspection plugs.

.6 Replaceable case wearing ring to be bronze with 304 stainless steel fasteners.

.7 All rotating components of the pump shall be statically and dynamically balanced as an assembled unit and shall be such as to produce a minimum vibration under service conditions.

.2 Pump Accessories

.1 Pump guide rail system shall be supported by the pump base plate assembly or the pump discharge elbow.

.2 The discharge elbow shall be cast-iron conforming to ASTM A-278.

.3 Anchor bolts - 316 stainless steel.

.4 Pump lifting/guide rail system shall be designed to allow removal of the pump without disturbing the discharge piping and shall be complete with stainless steel lifting chains.

.5 The pump discharge flange and the discharge elbow surface shall be machined and/or provided with seals to minimize leakage during pumping cycle.

.3 Motors

.1 General

.1 Motors shall be in accordance with EEMAC. Design Letter B, EEMAC Code Letter G and CSA Standards. Motors shall be suitable for inverter duty (except for scum pumps).

.2 Motors shall be provided in accordance with motor data listed below, and shall be capable of satisfactory operation at voltage of 10% above or below the rated value without harmful effects.

.3 Motors shall be sized to always exceed the kilowatt requirements of the pump at any point on the pump curve by at least 10%.

.4 Motors shall have a premium efficiency. Each motor shall have a 1.15 service factor or better.

.5 Motor winding, rotor and bearings to be in a sealed submersible type housing, with moisture sensing probe. Motors shall be capable of operating with motor only partially submerged.

.6 Motors shall be identified by a manufacturer's rating nameplate in permanently inscribed material attached to the unit.

.7 Motors shall be designed for continuous duty, submerged or not submerged, and shall be capable of at least 10 spaced starts per hour.

.8 Motors shall be fully overload protected.

.2 Motor Construction

.1 Bearings to be factory prelubricated for low maintenance and bearing life shall be not less than AFBMA B-10 life - 100,000 hours.

.2 Provide lifting lugs for full weight of pump and motor.

.3 Rotating components shall be statically and dynamically balanced to provide a minimum of vibration under service conditions.

.4 Provide double mechanical seals.

.3 Motor Protection

.1 Provide one (1) embedded resistance type temperature detector for winding temperature alarm with two (2) detectors in each phase of the startor windings for use with winding temperature relay in pump control panels.

.2 Resistance temperature detectors to be 100 ohm platinum type.

.4 Cables

.1 Power cables shall be sized to match the pump supplied, and the location and shall be fully waterproof cable and connections.

.4 System Accessories

.1 Supervisory Relay - Provide supervisory relay to monitor moisture, bearing and temperature sensors and provide contact output - Flygt control & status (CAS) monitoring unit or reviewed alternative.

2.4 CONTROL STRATEGY

.1 See Specification 43 71 23

2.5 SPARE PARTS AND MAINTENANCE MATERIALS

.1 Provide a list of critical spare parts

PART 3 EXECUTION

3.1 MANUFACTURER'S REPRESENTATIVE

.1 The Contractor shall unload and store the equipment at the site in a suitable fashion, as recommended by the equipment manufacturer. If required, the Contractor shall erect a suitable weather protected enclosure for equipment storage.

.2 The Contractor shall furnish and install equipment anchor bolts per the recommendations of the Equipment Contractor.

.3 The Contractor shall run and land all required electrical and control wires.

3.2 INSTALLATION

.1 Ensure the equipment is installed as required to provide satisfactory service.

.2 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installers understanding by completing Form 101 as illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.3 Cooperate with the installer to fulfill the requirements for a successful installation, as documented by Form 102, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.3 TESTING

.1 After installation, and start-up and debugging, the thickener feed pump shall be tested to assure conformance with the performance criteria. The performance criteria include the following:

.1 Pump flow rate in manual operation at minimum and maximum speed.

.2 Pump automatic operation based on the RDT control panel signals.

.2 The Owner reserves the right to evaluate any and all data from the testing program, and to formulate the final conclusions regarding performance on the basis of the demonstrate system performance.

.3 The pump supplier shall make any and all modifications to the system as required to provide satisfactory operation at no additional cost to the Owner.

.4 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.4 COMMISSIONING

.1 Commissioning is defined as a 30-day period of operation which with the following conditions:

.1 Fully automated operation

.2 No interruptions due to critical equipment or control system failure or unscheduled maintenance

.2 When commissioning testing are fulfilled, it should be documented by Form 104, illustrated in Section 01 66 20 – Commissioning and Handover.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

.1 This Section specifies the supply, testing and commissioning of all necessary equipment and controls for:

- .1 One Rotary Drum Thickener (RDT)
- .2 Flocculation Tank
- .3 Local Control Panel (for Rotary Drum Thickener, Rotary Drum Thickener Feed Pump, and Polymer Feed System.)
- .4 All other access platforms and appurtenances necessary for a complete and operational system

.2 The system is intended to thickened waste activated sludge from an SBR system operating in Sooke, BC. The system is intended to operate automatically and be fully integrated in the existing plant infrastructure.

.3 In addition to providing the control of the Rotary Drum Thickener the supplied Local Control Panel provided under this specification will also provide all required control components, hardware and software, necessary to provide the control of the related Polymer Feed System and the Rotary Drum Thickener Feed and Discharge Pumps.

.4 The Contractor will provide system installation under the Supplier guidance and will provide support during testing and commissioning.

1.2 SUBMITTALS

.1 Shop Drawings: Submit in accordance with Section 01 30 00 - Submittals, include the following:

- .1 Certified shop and erection drawings, showing all important details of construction, dimensions and anchor bolt locations.
- .2 Complete Bill of Materials
- .3 Descriptive literature, bulletins and/or catalogs of the equipment.
- .4 Ancillary equipment performance information.
- .5 Furnish all information required in shop drawing submittal requirements.
- .6 The total weight of the equipment, including the weight of the single largest item.
- .7 A list of the manufacturer's recommended spare parts. Include gaskets, packing and related items on the list. List bearings by the bearing manufacturer's numbers only

.2 Complete assembly and installation drawings, together with detailed specifications and data covering material used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section. The data and specifications for each unit shall include, but not be limited to, the following:

1. Rotary Drum Thickener and Auxiliary Equipment

    a. Type and model of unit
    b. Description of gravity drainage and screen
    c. Sludge flocculation tank details
    d. Shower header details
    e. Sludge feed, washwater and filtrate connections
    f. Type, make and full details of all bearings
    g. Gearbox literature
    h. Lubrication requirements
    i. Discharge system
    j. All material types, thicknesses, and finishes

2. Motors

    a. Name of manufacturer
    b. Type and model
    c Rated size of motor HP
    d. Temperature rating
    e. Base speed
    f. Net weight
    g. Maximum operating speed
    h. Rated voltage
    j. Constant Torque speed range
    l. Service factor

3. Control Panel

    a. Dimension and layout details
    b. Materials of construction
    c. Brand names and catalog literature on all control devices, such as, but not limited to:

        (1) PLC
        (2) Operator Interface Terminal
        (3) Fused disconnects
        (4) Motor starters
        (5) Terminal blocks
        (6) SCR controllers
        (7) Alarm initiating devices
        (8) All switches and lights
        (9) Timers, relays and related equipment
        (10) Control System equipment

    d. Electrical connection diagrams and ladder type schematics, identifying all items requiring electrical control or power for operation of the equipment, shall be submitted for review. Submittals shall verify each applicable feature in this Specification. All schematics shall number each wire and terminal to coincide with the assembled equipment. Each contact, timer and related items shall be labeled to coincide with the equipment installed in the local control panel and on the equipment. The

schematics shall be supplemented by a narrative detailing equipment start-up and shutdown functions as they relate to the electrical devices.

e. The drawings shall indicate the conduit and wiring requirements between the local control panel and thickener equipment that will be installed by the Contractor.

.3 Operation and Maintenance Manual: Provide data for incorporation in the Operation and Maintenance Manual. Include complete operation description together with process control narrative, general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogue with complete list of repair and replacement parts with Section drawings illustrating the connections and identifying numbers.

1.3 COORDINATION

.1 Coordinate with other Divisions to ensure there are no conflict in the work.

.2 Polymer Feed System is specified in Section 43 32 69

.3 Rotary Drum Thickener Pump is specified in Section 43 25 13

.4 The Owner will provide Thickened Sludge Pump

.1 The pump is positive displacement type by Sydex Model BK052-1L

1.4 QUALITY ASSURANCE

.1 Give complete responsibility for the final design, furnishing, coordination, assembly and installation supervision of all components in the RDT to a single manufacturer-supplier, regularly engaged in the design, manufacture, assembly and production of similar equipment. It is also intended that such a manufacturer-supplier make all adjustments, alterations, replacements, and tests specified and required, for a complete, satisfactory, and trouble-free operating installation.

1.5 SHIPMENT PROTECTION AND STORAGE

.1 Ship pre-assembled to the degree that is possible.

.2 Provide storage instructions indicating specific requirements to ensure there is no uneven wear, distortion, or weathering of components.

.3 Identify all other special storage requirements.

PART 2 PRODUCTS

2.1 DESCRIPTION

.1 Furnish all equipment and incidentals for one (1) Sludge Thickening system including one (1) Rotary Drum Thickener (RDT), one (1) Flocculation Tank with mixer, and one (1) local control panel. All equipment in this section shall be supplied by a single manufacture to ensure system responsibility and equipment compatibility.

.2 The system described herein shall be capable of thickening waste activated sludge (WAS). The thickened sludge shall be greater than 4.0% Total Solids.

.3 The sludge thickening equipment shall be designed to adequately condition and thicken the sludge such that thickened sludge is produced that easily discharges from the thickening unit, without blinding.

.4 The system shall be designed to operate in the environment for which it is intended, continuously or intermittently on demand, and shall perform the required thickening operations without spillage of water or sludge beyond the nominal machine envelope.

2.2 DESIGN CONDITIONS

Parameter	Value
Average daily sludge volume	136 m3/d
Typical sludge concentration	0.8% TS
Sludge composition	PS + WAS
Operation	Continuous or intermittent on demand

2.3 ACCEPTABLE MANUFACTURERS/SUPPLIERS

.1 Parkson Corporation

.2 JWC Environmental

.3 Approved alternative

2.4 MATERIALS

.1 All materials used in the construction of the sludge thickening equipment shall be of the best quality and entirely suitable in every respect for the service required. All materials shall conform to the ASTM Specifications where such specifications exist; the use of such materials shall be based on continuous and successful use under similar conditions of service.

.2 Unless otherwise specified herein, all materials in contact with polyelectrolyte or sludge shall be of Type 304 stainless steel.

Bearing housings	coated cast iron or
Covers	304 Stainless steel
Shower Header and nozzles	304 Stainless steel
Shower Header	304 Stainless Steel
Thickened Sludge Hopper	304 Stainless steel
Flexible Boot	Reinforced Molded Rubber
Drain pan	304 Stainless steel

Frame	304 Stainless Steel
Hardware, fasteners,	304 stainless steel
Flocculation tank	304 stainless steel

.3 RDT Structural framework

.1 The framework shall be of welded and/or bolted construction. All welding shall conform to the American Welding Society Structural Welding Code. The structure shall be designed for installation on a prepared concrete foundation and secured with anchor bolts. Permanent lifting lugs shall be provided as necessary, to allow installation and removal of the unit.

.2 The construction shall allow easy access and visual contact of all internal components.

.4 RDT Drum Support Shaft

.1 The full length drum support shafts shall be supported by a pillow block bearing mounted at each end outside the wetted environment. The shafts shall be fully coated with polyurethane and machined to match the drum support points. The polyurethane shall have a minimum thickness of ½ inch on all drum supporting surfaces. The shafts shall have stub ends manufactured from 17-4 stainless steel.

.2 Designs must incorporate all bearing located outside of the wetted environment.

.5 RDT Bearings

.1 All rollers shall be supported by 3” greaseable type, high capacity "E" design roller bearings, equipped with a metal cages, in sealed, splash proof, pillow block housings. All Shafts shall be supported by self-aligning spherical roller bearings mounted in fixed pillow block housings.

.2 All bearings shall have a minimum L10 bearing life of 675,000 hours, calculated by using the latest ANSI/AFBMA, standard. The L10 life shall be based on the summation of all forces applied to the bearings. Certified calculations, based on the AFBMA/ISO capacity formula, showing that all bearings comply with the specified requirements for minimum L10 bearing life, at maximum loadings, shall be submitted to the engineer as set forth in the contract documents.

.3 Bearing housings shall be class 30 cast iron with two stainless steel mounting bolts and two stainless steel cap bolts.

.4 The bearing seal in the pillow block housing shall be of nonmetallic construction with a carrier/flinger, which rotates with the roller shaft. A static sealing arrangement between the carrier/flinger and the shaft shall be a triple rubber seal, constructed in a manner that prevents relative rotation between the seal and the shaft. A dynamic sealing arrangement between the carrier/flinger and the bearing housing shall consist of a primary dynamic contact seal of ozone resistant rubber which shall seal by rotational contact with a machined housing surface.

.5 Bearing lubrication shall be performed through a type 304 stainless steel grease fitting mounted on the bearing housing. All bearings shall be greaseable while the unit is in operation. Lubrication shall not be required more often than once every month.

.6 RDT Wash System

.1 Each thickener shall be equipped with individual washwater systems. The shower system will be designed for 40 PSIG water pressure and shall not require the use of a booster pump. The spray tube and nozzle assembly shall be readily removable.

.2 Nozzle spacing and spray pattern shall be such that the sprays from adjacent nozzles overlap one another at the drum surface. Individual nozzles shall be replaceable.

.3 Each wash spray tube shall be positioned at the top of the drums and shall extend the full length the drum. The washwater system shall be suitable for use with plant effluent water supplied at a minimum pressure of 40 psig.

.4 The shower header shall be equipped with a manually operated handwheel attached to a flush valve and a series of internal brushes which can clean any debris accumulated on the inner surface of the nozzle orifice. When the handwheel is rotated counterclockwise, the flush valve is opened so debris dislodged from the nozzle orifices is flushed from the header. When the handwheel is rotated clockwise, the flush valve is closed and the header returned to normal operation.

.7 RDT Drum Drive

.1 Input power to the drive roller shaft is supplied through an A.C., high efficiency inverter rated motor via a VFD through a shaft mounted gearbox. The gearbox shall connect directly to the drive shaft. Drive roller rotational speed shall be controlled through variation in motor frequency, which is regulated by the operator input to a variable frequency drive controller. The VFD shall be mounted in the RDT local control panel.

.2 Alternatively drive sprocket and chain can be provided. Material should be 304 stainless steel including chain guard.

.8 RDT Filtrate Pan

.1 Filtrate pan shall be provided as necessary to contain filtrate from all dewatering areas within the thickener without splashing and to prevent re-wetting of downstream thickened sludge. All filtrate piping shall be furnished, adequately sized for the intended service, and rigidly attached to the thickener frame. Filtrate piping shall terminate at a flanged connection at the bottom of the filtrate

pan. Flushing connections or similar provisions shall be provided for easy access during cleaning. Filtrate pan shall be located such that the moving parts do not come into contact with the pan under any conditions.

.9 Flocculation Tank

.1 The Rotary Screen Thickener shall be provided with a sludge flocculation tank, designed to efficiently mix polymer with the sludge and to adequately condition the sludge for optimum thickener performance.

.2 The flocculation tank shall be mounted upstream of the thickener and shall consist of a flocculation tank, and a mechanical mixer mounted inside the flocculation tank.

.3 The flocculation tank shall be constructed of 304 stainless steel throughout. The flocculation tank shall be self-supporting.

.4 The flocculation tank shall be supplied with a mechanical mixer. The mixer shall be equipped with a TEFC, 575 VAC, 3 phase, inverter duty rated motor sized by the manufacturer to provide adequate mixing energy for the intended flow rate. The mixer motor speed shall be adjustable with a VFD mounted in the RDT local control panel.

.10 Control System

.1 One (1) local control panel (LCP) shall be furnished and installed for each thickening system. The RDT shall be controlled by the combined LCP that will contain all necessary control devices and equipment for complete controls of the RDT system, which includes but is not limited to controls for the thickener drum drive, wash system, polymer system, and feed pump etc.

.2 LCP Description:

.1 Each local control panel enclosure shall be free-standing and fabricated of type 304 stainless steel and shall be rated NEMA 4X, as manufactured by Hoffman or approved equal. The equipment, controls, components, and control panels for all thickening equipment and ancillary equipment shall be UL listed. The control panel shall be UL listed and shall be assembled in a UL listed facility. The local control panel and its ancillary control components shall be as specified herein and as specified in specification Sections 01 60 12 and 01 70 12.

.2 The control panel shall accept a 575 VAC, 60 hertz, 3 - phase power input and be equipped with a door interlocked fused disconnect. When the disconnect is in the open position, all power shall be removed from the control system.

.3 The local control panel shall be equipped with a control power transformer fused primary and secondary with 120VAC transient voltage surge suppressor (TVSS).

.4 The local control panel shall be equipped with a programmable logic controller (PLC) by Allen Bradley, CompactLogix PLC or ControLogix, with sufficient relays and timers to monitor equipment-mounted electrical devices and to perform necessary control functions. All required I/O modules, Ethernet communication modules, and power supplies, etc. shall be furnished to connect all available I/O into the PLC. The PLC in the LCP shall communicate to the plant control system using Ethernet.

.5 The equipment manufacturer shall provide IEC rated motor starters with short circuit protection for all motors in each RDT system. Motor control for the mixer motors, the drum drive motors, and the Thickened Sludge Pump shall be via variable frequency drives (VFDs) mounted inside the LCP. The speed of the floc tank mixer motors and the drum drive motors shall all be adjustable from the RDT local control panel. The speed of the Thickened Sludge Pump motor shall be controlled through the RDT local control panel to maintain a constant setpoint level in the thickened sludge hopper as determined by the level transmitter. All VFD's for the RDT system shall meet the requirements of Electrical Specification, Section 01 60 12.

.6 Located on the front of the control panel shall be an Allen Bradley PanelView 5000 or PanelView Plus 7 series HMI or equal (10" or larger) for operator control of the system.

.7 All other alarms, controls, switches, outputs, ladder logic programming, or other programming required to properly operate the RDT system, Polymer Feed System and the Rotary Drum Thickener Feed Pump shall be provided by the system manufacturer at no additional cost to the Owner.

.8 All RUN, FAIL, and ALARM status from all equipment shall be integrated and displayed on LCP HMI system. The Contractor shall be responsible for coordinating with the RDT equipment manufacturer and the Systems Integrator to provide the control and status of the equipment as specified on the existing plant SCADA system.

.9 Provide a front panel mounted HMI for local operator interface when the system is under PLC control. As a minimum, the following control pilot devices shall be located on the front of each RDT LCP to provide manual operation:

.1 RDT System EMERGENCY STOP mushroom style push-pull illuminated button

.2 CONTROL POWER ON-OFF selector switch

.3 CONTROL POWER ON status light

2.5 CONTROL STRATEGY

.1 The equipment manufacturer shall furnish at minimum, the controls as specified herein. The control strategy for any other items and equipment integral to the RDT and required for the proper operation of the RDT and its ancillary systems shall be programmed and controlled per the equipment manufacturer at no additional cost to the Owner.

.1 For RDT control, the LCP shall be equipped with a digital HAND-OFF-REMOTE switch. In HAND mode, the RDT shall be manually controlled by the operator using the START/STOP pushbuttons on the HMI. In REMOTE mode, the RDT shall be controlled from the Auto sequence command on the HMI and through the main plant PLC. The RDT equipment manufacturer shall be responsible for the control logic for the automatic operation of the RDT.

.2 For floc tank mixer control, the LCP shall be equipped with a digital HAND-OFF-AUTO switch. In HAND mode, the floc tank mixer shall be manually controlled by the operator using the START/STOP pushbuttons on the HMI. In REMOTE mode, the floc tank mixer shall be controlled from the Auto sequence command on the HMI.

.3 For Thickened Sludge Pump (supplied by the Owner) control, the LCP shall be equipped with a digital HAND-OFF-REMOTE switch. In HAND mode, the Thickened Sludge Pump shall be manually controlled by the operator using the START/STOP pushbuttons on the HMI. In REMOTE mode, the Thickened Sludge Pump shall be controlled from the Auto sequence command on the HMI. The Thickened Sludge Pump equipment manufacturer shall be responsible for the control logic for the automatic operation of the Thickened Sludge Pump.

.4 The RDT LCP shall control the sludge feed using the input from the flow meter (supplied by others) and the operator set-point for desired flow. The PLC shall vary the thin sludge feed pump (supplied by others) speed to maintain a constant flow to the RDT.

.5 The RDT LCP shall pace the polymer flow based on ratio control to the sludge feed into the RDT Flocculation Tank Only. A signal input for the flocculation tank flow meter will be used.

.6 The RDT LCP will control the Thickened Sludge Pump speed, based on the level hopper. The Thickened Sludge Pump will vary flow to maintain a constant level. The pump speed will be adjustable from a VFD located in the RDT LCP. The level input to the PLC will be provided from the thicken sludge hopper level transmitter.

.7 The equipment manufacturer shall be responsible for providing any interlocks required for the proper operation of RDT system.

2.6 PAINTING

.1 Shop prime and paint all ferrous components of the equipment with high build epoxy in accordance with Section 46 90 00.

.2 Finish stainless steel components in accordance with Section 46 90 00.

2.7 SPARE PARTS AND MAINTENANCE MATERIALS

.1 Provide a list of critical spare parts

PART 3 EXECUTION

3.1 MANUFACTURER'S REPRESENTATIVE

.1 The Contractor shall unload and store the equipment at the site in a suitable fashion, as recommended by the equipment manufacturer. If required, the Contractor shall erect a suitable weather protected enclosure for equipment storage.

.2 The Contractor shall furnish and install equipment anchor bolts per the recommendations of the Equipment Contractor.

.3 The Contractor shall set the thickeners, control panels, and appurtenant equipment on foundations and grout the units.

.4 The Contractor shall run and land all required electrical and control wires. The rotary drum thickener supplier shall coordinate with the plant system integrator to integrating the controls between the local panel and plant SCADA system.

3.2 INSTALLATION

.1 Ensure the equipment is installed as required to provide satisfactory service.

.2 Provide control system programming assistance to ensure effective data communication between the plant PLC/SCADA system, and signal sharing between the Polymer Blend System and the Rotary Drum Thickener Control.

.3 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installers understanding by completing Form 101 as illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.4 Cooperate with the installer to fulfill the requirements for a successful installation, as documented by Form 102, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.3 TESTING

.1 After installation, and start-up and debugging, the thickening unit shall be tested to assure conformance with the performance criteria.

.2 The Rotary Screen Thickeners shall be operated by the equipment manufacturer under the supervision of the engineer or plant staff. The unit shall be fed sludge and shall be operated until the unit reaches steady state optimum performance. The unit shall then begin a 2-day, 6-hour per day run period during which the average performance of the unit must equal or exceed the guaranteed performance parameters. If the unit fails to equal or exceed that required, or cannot operate continuously during the duration of the test, due to equipment failure, the test shall be repeated. The Contractor shall be given 30 calendar days to optimize performance to produce results to equal or exceeding the guaranteed performance criteria.

.3 The following sample feed rates, calibrations or setting, shall be taken in specified 1 hour intervals. Samples shall be taken by the Owner and analyzed by a laboratory designated by the Owner and paid for by the Owner.

.1 Sludge feed - total solids (sludge only).
.2 Filtrate – total suspended solids.
.3 Final thickened sludge - total solids.
.4 Polymer feed rate – Meters cubed per hour.
.5 Sludge feed rate - Liters per minute.
.6 Polymer feed pump Speed
.7 Setting for sludge feed pump.
.8 Setting for thickener drum drive speed.

.4 The average results of the two day test will be used to evaluate the equipment performance.

.5 The Owner reserves the right to evaluate any and all data from the testing program, and to formulate the final conclusions regarding performance on the basis of the demonstrate system performance.

.6 The thickener supplier shall make any and all modifications to the system as required to provide satisfactory operation at no additional cost to the Owner.

.7 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.4 COMMISSIONING

.1 Attend during commissioning of the process system that includes the equipment specified in this section and to ensure the equipment functions as intended in the process system.

.2 Commissioning is defined as a 30-day period of operation which with the following conditions:

.1 Fully automated operation
.2 Performance criteria achieved

.3 No interruptions due to critical equipment or control system failure or unscheduled maintenance

.3 When commissioning testing are fulfilled, it should be documented by Form 104, illustrated in Section 01 66 20 – Commissioning and Handover.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This section includes the general requirements for the supply, delivery, and assistance with installation, testing and placement into operation of a complete liquid polymer blending system and appurtenances as specified herein and as shown on the drawings. The equipment 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 Polymer Feed System:
  - .1 Make-down unit with duty / standby pumps
  - .2 All interconnecting piping, valves, wiring, and accessories to connect the pump assembly together to form a complete and workable chemical feed system.
  - .3 System controls

1.2 RELATED WORK

.1 Section 44 43 26 – Rotary Drum Thickener

.2 Section 43 25 13 – Rotary Drum Thickener Feed Pump

1.3 SUBMITTALS

.1 Submit information for polymer feed system as follows:

- .1 General layout, construction details, materials of construction and recommended spare parts list for the polymer make-down unit.
- .2 Polymer make-down unit data as required in the following list:
  - .1 Rated capacity (L/h) of polymer blender
  - .2 Dilution water requirements (L/h)
  - .3 Suction and discharge pipe sizes (mm)
- .3 Dimensioned layout of polymer make-down unit.
- .4 Submit detailed information related to requirements for each electrical motor to ensure that the Rotary Drum Thickener control panel can be fitted with power supply, motor starter (or VFD), and control components required to safely energize and operate the polymer feed system motors.
- .5 Submit system control drawings complete with details of all on skid components to be interfaced with the Rotary Drum Thickener control

panel including: complete bill of materials and all required wiring systems for all for polymer blender, metering pumps and controls.

.6 Provide a complete and detailed control narrative document. The document will provide all required information to allow the successful programming of the Rotary Drum Thickener PLC to provide safe and accurate control. The control narrative document will also indicate all system conditions that should be alarmed to the operator and a complete list of system performance parameters that should be recorded in a trend archive.

.7 General layout, construction details, and materials of construction for the day tank.

.8 Certified shop test results for the polymer feed system.

.9 Submit installation manuals before shipment of any equipment.

.10 Submit as part of the bound, indexed manual for all equipment, the installation, operation and maintenance manuals, 30 days prior to start up.

.11 Diluted polymer metering pumps capacity, turndown ratio, dimensions, general layout, installation details, and recommended spare parts list.

1.4 MANUFACTURERS

.1 The polymer make-down 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 polymer make-down unit shall be:

.1 Polyblend,

.2 Fluid Dynamics,

.3 DulcoBlend, or

.4 Approved alternative.

Part 2 Products

2.1 SERVICE CONDITIONS

.1 The polymer feed systems shall be provided to feed polymer solution to the application point which is a flocculation tank of the Rotary Drum Thickener. The polymer feed rate is normally determined based on the sludge flow rates and chemical dose requirements.

.2 The design criteria are as follows:

.1 Design Waste Activated Sludge Flow: 136 m3/d

.2 Design WAS solids: 1155 kg/d

.3 Sludge composition: mixture of PS + WAS from SBR system

.3 Polymer Blending system

.1 Neat Polymer Dose: 2.0 – 7.0 g of polymer per kg of dry solids

.2 Polymer dilution ratio: up to 200:1

.3 Neat polymer pump rate minimum turndown ratio 100:1

.4 Neat polymer pump suction lift: minimum 2 m

.4 Assume neat product composition to be 100% product.

2.2 POLYMER BLENDING SYSTEM

.1 The neat polymer will be transferred to the dilution blender by the metering pump(s). Water will be supplied to the dilution blender simultaneously in proportion to the chemical flow to dilute the polymer solution to a concentration of 0.5 to 1.0 %. The dilution ratio shall be adjustable from the control panel of the make-down system.

.2 The polymer blending equipment shall be skid mounted and shall include duty and shelf spare metering pumps and polymer dilution blender(s) as specified below, and complete with piping, accessories, and instrumentations.

.3 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.

.4 The dilution blender shall have a 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.

.5 A flow sensor shall be provided for each system to shut down the system upon water flow interruption.

.6 All Polymer feed system measurement and control signals (discrete status, discrete command, analog measurement and analog command) shall be wired to a single marshalling junction box. Wiring interconnections between the marshalling junction box and the Rotary Drum Thickener control panel is to be provided by the project contractor based on system supplier drawings.

.7 The marshalling junction box and related components shall meet the requirements defined in *Section 01 60 12 General Electrical Requirements* and *Section 01 70 12 General Instrument Requirements* of this specification.

.8 The polymer system motors shall be provided with a ON/OFF lockable disconnect switch at each motor power connection.

.9 Electric motors smaller than 0.75Hp are to be feed at 120VAC from motor starters, or DC drives, located within the Rotary Drum Thickener system control panel. Electric motors larger than 0.75Hp are to be feed at 600V 3Ø from motor starters or variable frequency drives installed in the project supplied Motor Control Center, and controlled from the Rotary Drum Thickener system control panel.

.10 All supplied electrical systems and components shall meet the requirement of the Canadian Electrical Code and the requirements specified in *Section 01 60 12 General Electrical Requirements* of this specification.

Part 3 Execution

3.1 MANUFACTURER'S REPRESENTATIVE

.1 The Contractor shall unload and store the equipment at the site in a suitable fashion, as recommended by the equipment manufacturer. If required, the Contractor shall erect a suitable weather protected enclosure for equipment storage.

.2 The Contractor shall furnish and install equipment anchor bolts per the recommendations of the Equipment Contractor if required.

.3 The Contractor shall run and land all required electrical power and control wiring between vendor supplied connection points.

3.2 INSTALLATION

.1 Ensure the equipment is installed as required to provide satisfactory service.

.1 The services of the field representative should be included as needed and described in the equipment submittal.

.2 The Owner shall notify The Supplier when the installation of the polymer blending system has been completed. A representative of the supplier shall inspect the installation. The Owner shall be advised in writing of any corrections or adjustments that are required for the equipment installation. After the installation has been completed to the supplier's satisfaction, a letter of certification that all equipment is installed in accordance with its instructions and that the equipment is ready for operation shall be furnished.

.3 A process engineer shall complete operator process training including review of the controls description, a discussion of the process control features, instrument calibration and maintenance procedures, and

recommend adjustments to process setpoints based on initial plant operating data.

.2 Provide control system programming guidance and assistance to ensure complete and accurate control of the Polymer Blend System is provided from the Rotary Drum Thickener control panel.

.3 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installers understanding by completing Form 101 as illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

.4 Cooperate with the installer to fulfill the requirements for a successful installation, as documented by Form 102, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.3 TESTING

.1 After installation, and start-up and debugging, the polymer system shall be tested to assure conformance with the performance criteria. The performance criteria include the following:

.1 Polymer flow rate.

.2 Water flow rate and dilution ratios

.2 The Owner reserves the right to evaluate any and all data from the testing program, and to formulate the final conclusions regarding performance on the basis of the demonstrate system performance.

.3 The polymer system supplier shall make any and all modifications to the system as required to provide satisfactory operation at no additional cost to the Owner.

.4 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01 65 00 – Equipment Installation and Operational Testing.

3.4 COMMISSIONING

.1 Commissioning is defined as a 30-day period of operation which with the following conditions:

.1 Fully automated operation

.2 No interruptions due to critical equipment or control system failure or unscheduled maintenance

.2 When commissioning testing are fulfilled, it should be documented by Form 104, illustrated in Section 01 66 20 – Commissioning and Handover.

END OF SECTION