



**District of Port Hardy**



**Tender Documents for New Fort  
Rupert Reservoir and Replacement  
Water Treatment Reservoir -  
Contract 2**

**TENDER #: 1220-20-519-2017**

October 2017

**Project Tender Document**

**1220-20-519-2017**  
(Tender #)

**New Fort Rupert Reservoir and Replacement Water Treatment Reservoir - Contract 2**  
(TITLE OF CONTRACT)

**Table of Contents**

The complete Project Construction Documents consist of the following parts:

1. Standard Documents (supplied):
  - Table of Contents ..... TC 1
  - Invitation to Tender ..... INV 1
  - Instruction to Tenderers - Part I .....IT 1 to IT 6
  - Form of Tender ..... FT 1 to FT 3
    - Appendix 1 - Schedule of Quantities and Prices .....FT 4
    - Appendix 2 - Preliminary Construction Schedule .....FT 5
    - Appendix 3 - Experience of Superintendent .....FT 6
    - Appendix 4 - Comparable Work Experience.....FT 7
    - Appendix 5 – Subcontractors .....FT 8
    - Appendix 6 – Force Account Rates .....FT 9
  - Form of Agreement .....FA 1 to FA 6
  - Schedule 1 - Schedule of Contract Documents ..... FA 5
  - Schedule 2 - List of Contract Documents ..... FA 6
  - Supplementary General Conditions .....SG Pages 1 to 3
  - Supplementary Specifications .....34 Pages
  
2. Non-Standard Documents (Supplied):
  - N/A
  
3. Standard Documents (**not supplied - See MMCD - Volume II Platinum Edition 2009**):
  - Instructions to Tenderers - Part II
  - General Conditions
  - Specification
  - Standard Detail Drawings

Owner: **District of Port Hardy**

(NAME OF OWNER)

Contract: **New Fort Rupert Reservoir and Replacement Water Treatment Reservoir  
- Contract 2**

(TITLE OF CONTRACT)

Reference No. **1220-20-519-2017**

(OWNER'S TENDER REFERENCE NO.)

**The Owner invites tenders**

**for:** Design & installation of 2,700 m<sup>3</sup> new reservoir at the Water Treatment Plant, and the Design and installation of a new 2,000 m<sup>3</sup> reservoir for the Fort Rupert area. Reservoirs will have underground stainless steel piping preinstalled to underside of foundation slabs. A detailed geotechnical investigation will take place at the Water Treatment Plant site by others (work included in Contract 1). Geotechnical report to be provided 4 weeks after signing of contract. Contractor required to consult with District to confirm WTP tank High Water level for design. Survey may be required. Final grading/reshaping required.

(BRIEF DESCRIPTION OF THE WORK)

**Contract Documents are available for:**

Download from the District of Port Hardy's website: [www.porthardy.ca](http://www.porthardy.ca)

(LIST ADDRESSES FOR DOCUMENT PICKUP)

On payment of a non-refundable amount of \$100 including GST payable to:

***District of Port Hardy***

(NAME THAT CHEQUE SHOULD BE PAYABLE TO)

**The Contract Documents are available for viewing at:**

District of Port Hardy's website: [www.porthardy.ca](http://www.porthardy.ca)

(ADDRESS WHERE CONTRACT DOCUMENTS CAN BE VIEWED)

**Tenders are scheduled to close:**

**Tender Closing Time:** 2 : 30 , PM local time

**Tender Closing Date:** November 6 , 20 17

**Deliver Tenders to one of the following Addresses:**

District of Port Hardy

Stantec Consulting Ltd.

7360 Columbia - Box 68

400 – 655 Tyee Road

Port Hardy, BC V0N 2P0

Victoria, BC V9A 6X5

Attn: Mr. Abbas Farahbakhsh

Attn: Jon Bell

(ADDRESS WHERE TENDERS MUST BE SUBMITTED)

**NAME OF OWNER'S REPRESENTATIVE**

Abbas Farahbakhsh

250-949-7779

(PHONE)

**1.0 Introduction.....IT 3**

**2.0 Tender Documents .....IT 3**

**3.0 Submission of Tenders .....IT 4**

**4.0 Additional Instructions to Tenderers.....IT 5**

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

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

Owner: **District of Port Hardy**

(NAME OF OWNER)

Contract: **New Fort Rupert Reservoir and Replacement Water Treatment Reservoir -  
Contract 2**

(TITLE OF CONTRACT)

Reference No. **1220-20-519-2017**

(OWNER'S TENDER REFERENCE NO.)

## 1.0 Introduction

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

### **New Fort Rupert Reservoir:**

Contractor to provide:

- Design, supply, and installation of concrete foundation and reservoir.
- Connection to existing stubbed piping above foundation level utilizing all stainless piping.
- Design, supply, and installation of static mixer and internal stainless piping.
- Final grading / reshaping of site to suit design.

---

The Reservoir is to be a Glass Fused Bolted Steel

---

Tank Reservoir with 2,000m<sup>3</sup> capacity on a concrete foundation with all stainless-steel piping/fixtures.

---

### **Replacement Water Treatment Reservoir:**

Contractor to provide:

- Design, supply, and installation of concrete foundation and reservoir.
- Connection to existing stubbed piping utilizing all stainless piping.
- Design, supply, and installation of static mixer and internal stainless piping.
- Final grading / reshaping of site to suit design.

---

The Reservoir is to be a Glass Fused Bolted Steel

---

Tank Reservoir with 2,700m<sup>3</sup> capacity on a concrete foundation with all Stainless-Steel piping/fixtures including the static mixer.

---

- 1.2 Direct all inquiries regarding the *Contract*, to:  
Jon Bell, P.Eng. – Stantec Consulting Ltd.

(NAME AND POSITION OF INDIVIDUAL WHO WILL ANSWER INQUIRIES)

**Address:** #400-655 Tyee Road  
Victoria, BC V9A 6X5  
jon.bell@stantec.com

**Phone:** 250 388 - 9161

**Fax:** 250 382 - 0514

## 2.0 Tender Documents

- 2.1 The tender documents which a tenderer should review to prepare a tender consist of all of the *Contract Documents* listed in Schedule 1 entitled "Schedule of Contract Documents". Schedule 1 is attached to the Form of Agreement which is included as part of the tender package. The *Contract Documents* include the drawings listed in Schedule 2 to the Form of Agreement, entitled "List of *Contract Drawings*".
- 2.2 A portion of the *Contract Documents* are included by reference. Copies of these documents have not been included with the tender package. These documents are the Instructions to Tenderers - Part II, General Conditions, Specifications and Standard Detail Drawings. These documents are contained in the publication entitled "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings". Refer to Schedule 1 to the Form of Agreement or, if not specified in Schedule 1, then the applicable edition shall be the most recent edition as of the date of the *Tender Closing Date*. All sections of this publication are by reference included in the *Contract Documents*.
- 2.3 Any additional information made available to tenderers prior to the *Tender Closing Time* by the *Owner* or representative of the *Owner*, such as geotechnical reports or as-built plans, which is not expressly included in Schedule 1 or Schedule 2 to the Form of Agreement, is not included in the *Contract Documents*. Such additional information is made available only for the assistance of tenderers who must make their own judgment about its reliability, accuracy, completeness and relevance to the *Contract*, and neither the *Owner* nor any representative of the *Owner* gives any guarantee or representation that the additional information is reliable, accurate, complete or relevant.

**3.0 Submission of Tenders**      3.1

Tenders must be submitted in a sealed envelope, **marked on the outside with the Contract Title and Reference No.**, and must be received by the office of:

Mr. Abbas Farahbakhsh, Port Hardy Director of Operations or Jon Bell Stantec Consulting Ltd.

(TITLE OF POSITION)

on or before:

**Tender Closing Time:** 2 : 30, PM local time

**Tender Closing Date:** November 6, 20 17

at

**One of the following Addresses:**

District of Port Hardy | Stantec Consulting Ltd.

7360 Columbia - Box 68 | 400-655 Tyee Road

Port Hardy, BC V0N 2P0 | Victoria, BC V9A 6X5

**Phone:** 250 949 - 7779 | 250 389 - 2375

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



**4.0** **Additional  
Instructions to  
Tenderers**

- 4.1 Tenderers are reminded that completion of all required information on the Form of Tender, including the Appendices, is mandatory. Tenders lacking all required information will be rejected as incomplete.
- 4.2 The Tender must be accompanied by a Bid Security in the form of a Bid Bond. Tenders submitted without a Bid Bond will not be considered. Other forms of bid security noted in the Instructions to Tenderers Part II Section 5.2.2 are not acceptable.
- 4.3 The District of Port Hardy reserves the right to reject any and all tenders and the lowest tender will not necessarily be accepted.
- 4.4 The District and Stantec will not accept Tenders or revisions/ amendments to Tenders that are received by facsimile machine or email.
- 4.5 Except as expressly and specifically permitted in these instructions to Proponents/Tenderers, no Proponents/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.
- 4.6 The Tenderer must include Appendix 6 – Schedule of Force Account Rates. Fill in equipment and labour as needed in Appendix 6 to cover the equipment required to perform all works.

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

Owner: **District of Port Hardy**

(NAME OF OWNER)

Contract: **New Fort Rupert Reservoir and Replacement Water Treatment Reservoir – Contract 2**

(TITLE OF CONTRACT)

Reference No. **1220-20-519-2017**

To Owner:

**WE, THE  
UNDERSIGNED:**

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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ ;

(ADDENDA, IF ANY)

**ACCORDINGLY, WE  
HEREBY OFFER**

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

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

2.2 to achieve Substantial Performance of the *Work* on or before **154 Calendar Days after signing of contract** and to achieve Total Performance of the *Work* on or before **168 calendar days after signing of the Contract**; and

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

- WE CONFIRM:** 3.1 that we understand and agree that the quantities as listed in the *Schedule of Quantities and Prices* are estimated, and that the actual quantities will vary.
- WE CONFIRM:** 4.1 that the following appendices are attached to and form a part of this tender:
- 4.1.1 the appendices as required by paragraph 5.3 of the Instructions to Tenderers – Part II; and
  - 4.1.2 the *Bid Security* as required by paragraph 5.2 of the Instructions to Tenderers – Part II.
- 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 15 *Days* of receipt of the written *Notice of Award* deliver to the *Owner*:
    - .1 a Performance Bond and a Labour and Material Payment Bond, each in the amount of 50% of the Contract Price, covering the performance of the Work including the Contractor’s obligations during the Maintenance Period, issued by a surety licensed to carry on the business of suretyship in the province of British Columbia, and in a form acceptable to the *Owner*;
    - .2 a Baseline Construction Schedule, as provided by GC 4.6.1;
    - .3 a “clearance letter” indicating that the tenderer is in Worksafe BC compliance; and
    - .4 a copy of the insurance policies as specified in GC 24 indicating that all such insurance coverage is in place and;
  - 5.1.2 Within 2 *Days* of receipt of written “*Notice to Proceed*”, or such longer time as may be otherwise specified in the *Notice to Proceed*, commence the *Work*; and
  - 5.1.3 Sign the Contract Documents as required by GC 2.1.2.
- WE AGREE:** 6.1 that, if we receive written *Notice of Award* of this *Contract* and, contrary to paragraph 5 of this Form of Tender, we:

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

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

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

- .1 the face value of the *Bid Security*; and
- .2 the amount by which our *Tender Price* is less than the amount for which the *Owner* contracts with another party to perform the *Work*.

**OUR ADDRESS IS AS FOLLOWS:**

1

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Attention: \_\_\_\_\_

This Tender is executed this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_.

*Contractor:*

\_\_\_\_\_  
(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

\_\_\_\_\_  
(AUTHORIZED SIGNATORY)

\_\_\_\_\_  
(AUTHORIZED SIGNATORY)

**New Fort Rupert Reservoir and Replacement Water Treatment Reservoir - Contract 2**

**SCHEDULE OF QUANTITIES AND PRICES**

(see paragraph 5.3.1 of the Instructions to Tenderers - Part II)

(All Prices and Quotations shall include all taxes, but shall not include GST. GST shall be shown separately)

<b>Master Municipal Specifications</b>		<b>GENERAL REQUIREMENTS</b>		
<b>DESCRIPTION</b>				
Bonding and Insurance		Incidental to Contract		
Clearing and Grubbing		Incidental to Contract		
Reshaping Existing Subgrade		Incidental to Contract		
<b>Master Municipal Specifications</b>		<b>SITE WORK</b>		
<b>DESCRIPTION</b>		<b>UNIT</b>	<b>QTY</b>	<b>UNIT PRICE</b>
<b>EXTENDED AMOUNT</b>				
<b>CONTRACT SPECIFIC INSTRUCTIONS</b>				
Mobilization & Demobilization		Incidental to Contract		
<b>TRAFFIC CONTROL</b>				
Traffic Control		Incidental to Contract		
<b>ENVIRONMENTAL PROTECTION</b>				
Environmental Protection		Incidental to Contract		
<b>RESHAPING EXISTING SUBGRADE</b>				
Reshaping Existing Subgrade		Incidental to Contract		
<b>WATERWORKS</b>				
Payment for reservoirs include: Reshaping of existing subgrade, disposal of surplus excavated materials, bedding, compaction, supply and installation of all pipe, bolts, gaskets, pressure and leak testing, flushing and disinfection, and all required water sampling and testing (by a qualified independent consultant).		NOTE		
Fort Rupert Reservoir 2,000 m3 Glass Fused Bolted Steel Tank		L.S.	1	
Stainless Steel Process Piping		L.S.	1	
Replacement Water Treatment Reservoir 2,700 m3 Glass Fused Bolted Steel Tank		L.S.	1	
Stainless Steel Process Piping		L.S.	1	
<b>HYDRAULIC STATIC MIXER SYSTEM</b>				
Fort Rupert Reservoir Static Mixer		L.S.	1	
Replacement Water Treatment Reservoir Static Mixer		L.S.	1	
				<b>Subtotal (Excluding GST)</b>
				<b>Contingency (15%)</b>
				<b>Total (Excluding GST)</b>

**New Fort Rupert Reservoir and Replacement Water Treatment Reservoir – Contract 2**

(TITLE OF CONTRACT)

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

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

MILESTONE DATES: Shown below. Schedule commences at date of signed contract and Substantial Performance to be 154 Calendar Days after, and Total Performance to be 168 Calendar Days after.

ACTIVITY	CONSTRUCTION SCHEDULE																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<b>New Fort Rupert Reservoir</b>																								
Tank Design				X																				
Hydraulic Mixer Design				X																				
Approved Shop Drawings					X																			
Commencement of Fabrication						X																		
Commencement of Construction																		X						
Substantial Performance																						X		
Total Performance																								X
<b>Replacement Water Treatment Reservoir</b>																								
Tank Design								X																
Hydraulic Mixer Design								X																
Approved Shop Drawings									X															
Commencement of Fabrication										X														
Commencement of Construction																		X						
Substantial Performance																						X		
Total Performance																								X

Tenderer's Initials \_\_\_\_\_

**New Fort Rupert Reservoir and Replacement Water Treatment  
Reservoir – Contract 2**

(TITLE OF CONTRACT)

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

**Name:** \_\_\_\_\_

**Experience:** \_\_\_\_\_

**Dates:** \_\_\_\_\_

Project Name: \_\_\_\_\_

Responsibility: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

References: \_\_\_\_\_

\_\_\_\_\_

**Dates:** \_\_\_\_\_

Project Name: \_\_\_\_\_

Responsibility: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

References: \_\_\_\_\_

\_\_\_\_\_

**Dates:** \_\_\_\_\_

Project Name: \_\_\_\_\_

Responsibility: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

References: \_\_\_\_\_

\_\_\_\_\_

**Dates:** \_\_\_\_\_

Project Name: \_\_\_\_\_

Responsibility: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

References: \_\_\_\_\_

*Tenderer's Initials* \_\_\_\_\_

**New Fort Rupert Reservoir and Replacement Water Treatment Reservoir – Contract 2**

(TITLE OF CONTRACT)

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

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

Tenderer's Initials \_\_\_\_\_



**New Fort Rupert Reservoir and Replacement Water Treatment Reservoir – Contract 2**

(TITLE OF CONTRACT)

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

TENDER ITEM	TRADE	SUBCONTRACTOR NAME	PHONE NUMBER

*Tenderer's Initials* \_\_\_\_\_

**New Fort Rupert Reservoir and Replacement Water Treatment Reservoir – Contract 2**

(TITLE OF CONTRACT)

See paragraph 4.6 of the Instructions to Tenderers – Part I.

<b>LABOUR</b>	<b>HOURLY RATE</b>	<b>OVERTIME RATE</b>
Superintendent		
Foreman		
Pipe Layer		
Equipment Operator		
Skilled Labourer		
Unskilled Labourer		
Truck Driver		
Concrete Finisher		
Carpenter / Form Maker		
Electrician		
Flag Person		
Welder		

*Tenderer's Initials*

\_\_\_\_\_

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

BETWEEN *OWNER* AND *CONTRACTOR*

This agreement made in duplicate this

\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**New Fort Rupert Reservoir and Replacement Water Treatment**

Contract: **Reservoir – Contract 2**

(TITLE OF CONTRACT)

Reference No. **1220-20-519-2017**

(OWNER'S TENDER REFERENCE NO.)

BETWEEN:

The District of Port Hardy

\_\_\_\_\_  
(NAME OF OWNER)

(the "Owner")

AND:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(NAME AND OFFICE ADDRESS OF CONTRACTOR)

(the "Contractor")

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

- |  |     |  |
|--|-----|--|
| <b>Article 1 The Work Start / Completion Dates</b> | 1.1 | The <i>Contractor</i> will perform all <i>Work</i> and provide all labour, equipment and material and do all things strictly as required by the <i>Contract Documents</i> .  |
|  | 1.2 | The <i>Contractor</i> will commence the <i>Work</i> in accordance with the <i>Notice to Proceed</i> . The <i>Contractor</i> will proceed with the <i>Work</i> diligently, will perform the <i>Work</i> generally in accordance with the construction schedules as required by the <i>Contract Documents</i> and will achieve: <i>Substantial Performance</i> of the <i>Work</i> on or before <b><u>154 calendar days after signing of contract</u></b> and <i>Total Performance</i> of the <i>Work</i> on or before <b><u>168 calendar days after signing of contract</u></b> subject to the provisions of the <i>Contract Documents</i> for adjustments to the <i>Contract Time</i> . |

**Article 2 Contract Documents**

- 1.3 Time shall be of the essence of the *Contract*.
- 2.1 The "*Contract Documents*" consist of the documents listed or referred to in Schedule 1, entitled "Schedule of Contract Documents", which is attached and forms a part of this Agreement, and includes any and all additional and amending documents issued in accordance with the provisions of the *Contract Documents*. All of the *Contract Documents* shall constitute the entire *Contract* between the *Owner* and the *Contractor*.
- 2.2 The *Contract* supersedes all prior negotiations, representations or agreements, whether written or oral, and the *Contract* may be amended only in strict accordance with the provisions of the *Contract Documents*.

**Article 3 Contract Price**

- 3.1 The price for the *Work* ("*Contract Price*") shall be the sum in Canadian dollars of the following
- 3.1.1 the product of the actual quantities of the items of *Work* listed in the *Schedule of Quantities and Prices* which are incorporated into or made necessary by the *Work* and the unit prices listed in the *Schedule of Quantities and Prices*; plus
- 3.1.2 all lump sums, if any, as listed in the *Schedule of Quantities and Prices*, for items relating to or incorporated into the *Work*; plus
- 3.1.3 any adjustments, including any payments owing on account of *Changes* and agreed to *Extra Work*, approved in accordance with the provisions of the *Contract Documents*.
- 3.2 The *Contract Price* shall be the entire compensation owing to the *Contractor* for the *Work* and this compensation shall cover and include all profit and all costs of supervision, labour, material, equipment, overhead, financing, and all other costs and expenses whatsoever incurred in performing the *Work*.

**Article 4 Payment**

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

**Article 5 Rights and Remedies**

- 5.1 The duties and obligations imposed by the *Contract Documents* and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.
- 5.2 Except as specifically set out in the *Contract Documents*, no action or failure to act by the *Owner*, *Contract Administrator* or *Contractor* shall constitute a waiver of any of the parties' rights or duties afforded under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach under the *Contract*.

**Article 6 Notices**

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

The *Owner*:

District of Port Hardy

7360 Columbia - Box 68

Port Hardy, BC V0N 2P0

Fax: 250 949 7433

Attention: Abbas Farahbakhsh, Director of Operations

The *Contractor*:

Fax: \_\_\_\_\_

Attention: \_\_\_\_\_

The *Contract Administrator*:

Stantec Consulting Ltd

#400-655 Tyee Road

Victoria, BC V9A 6X5

Fax: 250 382 0514

Attention: Jon Bell, P.Eng.

- 6.2 A communication or notice that is addressed as above shall be considered to have been received
  - 6.2.1 immediately upon delivery, if delivered by hand; or
  - 6.2.2 immediately upon transmission if sent by fax and received in

hard copy; or

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

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

6.4 The sender of a notice by fax assumes all risk that the fax is received in hard copy.

**Article 7 General**

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

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

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

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

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

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

*Contractor:*

\_\_\_\_\_  
(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

\_\_\_\_\_  
(AUTHORIZED SIGNATORY)

\_\_\_\_\_  
(AUTHORIZED SIGNATORY)

*Owner:*

District of Port Hardy

\_\_\_\_\_  
(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

\_\_\_\_\_  
(AUTHORIZED SIGNATORY)

\_\_\_\_\_  
(AUTHORIZED SIGNATORY)

(INCLUDE IN LIST ALL DOCUMENTS INCLUDING, IF ANY, SUPPLEMENTARY GENERAL CONDITIONS, SUPPLEMENTARY SPECIFICATIONS, SUPPLEMENTARY STANDARD DETAIL DRAWINGS.)

**Schedule 1 Schedule of Contract Documents**

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

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

- Form of Agreement, including all Schedules;
- Supplementary General Conditions;
- General Conditions\*;
- Supplementary Specifications;
- Specifications\*;
- Standard Detail Drawings\*;
- Executed Form of Tender, including all Appendices;
- *Contract Drawings* listed in Schedule 2 to the Form of Agreement, – "List of *Contract Drawings*";
- Instructions to Tenderers - Part I;
- Instructions to Tenderers - Part II\*;
- The following Addenda:

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(ADDENDA, IF ANY)





These Supplementary General Conditions must be read in conjunction with the Master Municipal General Conditions contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions

**SG 3.4 Inspection and Site Inspector**

**SG 3.4.9 (Add Clause 3.4.9 as follows)**

The *Contract Administrator*, the *Owner*, and the *Contractor* shall take part in a pre-construction site inspection prior to the *Work* commencing. This shall include a photographic and video survey. The date and time for this meeting shall be set by the *Contract Administrator*.

**SG 4.2 Safety**

**SG 4.2.2 (Add Clause 4.2.2 as follows)**

The *Contractor* shall have daily safety meetings, prepare daily hazard assessments and work plans. These may be reviewed by the *Contract Administrator* from time to time.

**SG 4.6 Construction Schedule**

**SG 4.6.2 (Delete Clause 4.6.2 and replace as follows)**

The *Contractor* shall provide the *Contract Administrator* with weekly updates to the Baseline Construction Schedule (the "Adjusted Baseline Schedule") that reflects any adjustments to the Milestone Dates or the Contract Time as provided by the *Contract Documents*, including without limitation if the *Contract Administrator* issues a Change Order or other Contract Document(s) which adjusts any Milestone Date(s). Each Adjusted Baseline Schedule will replace the previous Baseline Schedule.

**SG 4.16 Notice of Disruption**

**SG 4.16.2 (Add Clause 4.16.2 as follows)**

The *Contractor* shall designate a public relations program contact who shall be responsible for implementing all measures of the public relation program, and who shall be the contact for any public concerns or questions."

Written Notice to be delivered to each home or business describing work, schedule and how it affects them. Provide a phone number and the name of the person to be contacted in case of any complaints related to the *Contractor's* work, or to discuss the project or their problems. Notice to be delivered a minimum of one week prior to the anticipated construction start date.

Notification template will be supplied to the *Contractor* to use for Public Notifications. Contractor will be required to fill in any additional information required on the template (i.e. dates of service disconnection and connection etc.) and deliver these notices as per the contract requirements. Verification of notice delivery will be required. The *Contract Administrator* will review the notices from Contractor and will keep the District informed with respect to Public Notifications.

SG 4.16.3 **(Add Clause 4.16.3 as follows)**

The *Contractor* shall provide public notification as follows:

- .1 48 hours' notice is required for temporary utility shut downs;
- .2 5 days' notice is required for utility long term shut downs that require temporary water service connections.
- .3 5 days' notice for any road closures directly affecting the public (ex. closing the alley behind their house or the road in front of their house.)

**SG 13.9 Liquidated Damages for Late Completion**

SG 13.9.1 **(Delete Clause 13.9.1 and replace as follows)**

If the *Contractor* fails to meet the Milestone Date for *Substantial Performance* as set out in the Form of Tender, paragraph 2.2 as may be adjusted pursuant to the provisions of the *Contract Documents*, then the *Owner* may deduct from any monies owing to the *Contractor* for the *Work*. Liquidated damages will be assessed at this time.

**SG 20.1 Laws**

SG 20.1.2 **(Add Clause 20.1.2 as follows)**

Written permission from the *Contract Administrator* will be required for any works to be performed during periods that do not conform to District of Port Hardy bylaws. In case the *Contractor* decides to work on a day which is a Statutory Holiday, he shall provide the *Contract Administrator* in writing at least four (4) business days in advance of such holiday, stating those places where said work is to be conducted. In case the *Contractor* fails to give such notice in advance of any Statutory Holiday, no work within the terms of the *Contract* shall be done on such holiday.

**SG 21.0 Workers Compensation Regulations**

SG 21.1 **(Delete Clauses 21.1.1 to 21.1.2 and replace as follows)**

SG 21.1.1 The Contractor will comply with the Worker's Compensation Act and in particular will obtain and maintain during the term of the Contract the necessary coverage for the Contractor's employees and sub contractors. Prior to receiving any payment, the Contractor may be required to submit a Worksafe BC Clearance Letter indicating that all Worksafe BC assessments have been paid.

SG 21.2 ***(Delete Clause 21.2.1 and replace as follows)***

SGC 21.2.1 The Contractor will be assigned Prime Contractor status and will be subject to Worksafe BC Prime Contractor requirements.

**SG 24.0 Insurance**

SG 24.1 ***(Delete Clauses 24.1.1 to 24.1.6 and replace as follows)***

SG 24.1.1 The Contractor will, without limiting its obligations or liabilities and at its own expense, provide and maintain throughout the Contract term, Comprehensive, General Liability Insurance in the amount not less than \$3,000,000.00 inclusive per occurrence insuring against bodily injury, personal injury and property damage and including liability assumed under Contract in the forms and amounts acceptable to the District of Port Hardy. All required insurance shall be endorsed to provide the District of Port Hardy with 30 days advance written notice of cancellation or material change. The Policy shall provide an endorsement including the District of Port Hardy and Stantec Consulting Ltd. as additional insured.

SG 24.1.2 The Contractor will at the Contractor's expense, carry with an insurance company or companies and under policies of insurance acceptable to and approved by the Owner Automotive Liability Insurance (Owned and Non-Owned Units) Limits: Bodily Injury and Property Damage – inclusive each accident \$3,000,000.

The Contractor shall, at the Contractors expense, throughout the term of the Contract, maintain such insurance as required under the Insurance (Motor Vehicle) Act of British Columbia.

SG 24.1.3 The Contractor will provide the District of Port Hardy with evidence of the required insurance, in the form of a completed Certificate of Insurance, immediately following execution and delivery of a Contract.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

## **1.0 GENERAL**

- .1 All work called for in these Contract Documents, shown on the drawings or which is necessary for the completion of the Work called for in these Contract Documents and which is not specifically listed as a separate item in the Form of Tender is deemed to be incidental to the performance of the Work and to the general purpose of the Contract: no separate payment will be made on account of any such Work, but the cost of any such incidental Work shall be included in the Contract Price.
- .2 Payment for Contract 2 contract items are to be Lump Sum. Payment to include Design sealed by an engineer certified in BC, supply, fabrication, delivery, storage, site layout/prep/grading, construction and incidental work for which separate payment is not specified elsewhere, and the contractor's overhead and profit.
  - .1 Work includes all work required to complete the works included and required on the contract documents and for all incidental work for which payment is not specified elsewhere.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

**1.7 RECORDING ACTUAL SITE CONDITIONS**

**1.7.5 (*Add Clause 1.7.5 as follows*)**

The *Contractor* shall take regular photographs of the construction from the beginning of the project through to final close out of the project. These photos shall be submitted to the *Contract Administrator* on a weekly basis.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

**1.6 PAYMENT**

**1.6.1 *(Delete Clause 1.6.1 and replace as follows)***

Payment for all materials and work performed under this Section will be made at the respective Lump Sum bid for each Reservoir Section 33 69 00.

**3.0 EXECUTION**

**3.0 *(Delete Clause 3.0 and replace as follows)***

Environmental Management Plan and Erosion and Silt Control shall include completion and submission of the Environmental Management Plan acceptable the Owner and the Owner's Representative, compliance with the all requirements of the Environmental Management Plan including erosion and silt control, and all incidental work.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

**1.0 GENERAL**

**1.0.2 (*Add Clause as follows*)**

Contractor to refer to the Geotechnical Reports for Reservoir foundation design criteria.

- .1 Report for New Fort Rupert Reservoir "*Geotechnical Investigation for New Reservoir*" (Stantec, September 22, 2017).
- .2 Geotechnical report for Replacement Water Treatment Reservoir to be provided four weeks from signing of contract.

These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.

## 1.0 GENERAL (ADD CLAUSES AS FOLLOWS)

1.0.2 Compaction testing to be performed by a qualified Geotechnical Firm in a grid of every 5.0m under building and reservoir foundations.

- .1 If works are filled in, Contractor to uncover works to provide Geotechnical engineer with access to each lift to be tested.
- .2 Provide compaction results to the Engineer immediately upon receipt.
- .3 Compaction reports must clearly state the location (using drawing stationing) and lift depth.
- .4 If compaction reports are outside of the requirements specified above the Contract Administer may direct the Contractor to expose various sections for retesting. At a cost borne by the Contractor.
- .5 Minimum required compaction regardless of location is 95% Modified Proctor Density.

## 1.7 DISPOSAL

1.7.1 *(Delete Clause 1.7.1 and replace as follows)*

The Contractor shall dispose of excess common excavation and unsuitable material at an off-site location approved by the *Owner* at the Contractors expense.

## 3.3 Excavation

*(Add Clause as follows)*

3.3.13 Subgrade Preparation:

- .1 Subgrade shall be protected from freezing, wetting, or drying. Any surfaces that dry or become wet must be scarified, moisture conditioned, and recompacted.
- .2 Remove all logs, trees, brush, stumps, roots, and other deleterious material from the specified areas except for trees or vegetation designated to be preserved.



- .3 Remove all stumps and roots and other deleterious materials to 900 mm below the ground surface.
- .4 Remove unsuitable organic soils, rubbish fills, concrete and other undesirable materials
- .5 Perform topsoil and subsoil stripping. Topsoil and subsoil are as described in the Canadian System of Soil Classification.
- .6 Drain surface water away from the stripped areas to prevent ponding and infiltration in fill placement areas
- .7 Remove debris, snow, ice, water, and loose material prior to starting fill placement. Do not place fill material when the material, the foundation, or the surface on which it would be placed is frozen.
- .8 Moisten if required, and scarify the foundation surface to a minimum depth of 200 mm to obtain a good bond prior to placing the first lift of fill. [Scarification of bedrock foundation surfaces is not required.]
- .9 Grade and compact the scarified foundation surface to the same density specified for the overlying fill.
- .10 Remove all projecting knobs of rock to facilitate operation of compaction equipment and avoid differential settlement if bedrock discovered.

### **3.5 BACKFILL AND COMPACTION**

#### **3.5.1 (Replace 3.5.1 as follows)**

General: The Fill Placement will meet the following requirements:

- .1 Do not place fill material on any surface until the prepared surface has been inspected by the Engineer's Representative. Rectify any defects, including any identified by the Engineer.
- .2 Stump holes must be filled and hand compacted.
- .3 Construct fill zones at the locations, and to the lines, grades, slopes, and elevations specified in the Contract Documents, or as established by the Engineer, using fill materials that are placed, conditioned, and compacted to the specified requirements.
- .4 Overbuild final fill slopes and then trim them to the lines, grades, slopes, and elevations specified in the Contract Documents.

- .5 Maintain the top surface of fill zones approximately horizontal. During spreading and compaction, provide the surface of the fill zone with a gentle transverse gradient of 3% to 5% so that water from precipitation will drain freely toward the extremities of the fill zone but away from any filter materials.
- .6 Place and spread fill materials in continuous and approximately horizontal layers of uniform thickness in such a manner as to prevent segregation and stratification and to obtain a homogeneous mass.
- .7 Moisten each previously placed lift, if necessary, and work with discs to a minimum depth of 50 mm to provide a bonding surface prior to placing the overlying lift of fill material except when such work cannot be performed because of cold weather.
- .8 Protection:
  - .1 Suspend fill placement operations at any time when work cannot be performed in accordance with the specifications on account of rain, flooding, cold weather, or other unsatisfactory conditions.
  - .2 Immediately prior to any suspension in fill operations, slope the fill surface as specified and roll with rubber tire equipment or smooth cylindrical roller so as to leave the surface area in a smooth, even condition for drainage.
  - .3 Protect compacted fill and foundation surfaces that have been prepared for receiving fill from freezing by using a temporary layer of soil or insulating materials, where necessary. Remove protection only when the Contractor is ready to place fill.
  - .4 If necessary, condition, rework, and re-compact or remove and replace any portion of the fill or foundation that has suffered a reduction in quality due to drying, frost, rain, or any other reason to the specified requirements before placing succeeding layers.

**3.5.5 (Add 3.5.5 as follows)**

All subgrade surfaces to be protected from wetting, drying, and freezing before and during placement. Any surfaces that dry or become wet must be scarified, moisture conditioned, and recompacted.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

**1.0 GENERAL**

**1.0.3 *(Add 1.0.3 as follows)***

Contractor to perform tie in to existing system as shown on contract drawings. Pipe stubbed out to 300mm above the foundation slab finished floor elevation by others.

**1.8 MEASUREMENT AND PAYMENT**

**1.8.15 *(Add 1.8.15 as follows)***

Lump Sum Payment for interior stainless piping will include connection to existing stubs. Payment shall include, installation of all stainless steel pipe, fittings, bolts, gaskets, restrainers, x-rays (if field welding), cleaning pressure and leak testing, flushing, disinfection, all surface restoration as specified under Section 31 23 01 - Excavation, Trenching and Backfilling or 31 22 16.1 – Reshaping Existing Subgrade, and all other work required to complete the installation as shown on the Drawings and specified under this section.

**2.0 PRODUCTS**

**2.1 GENERAL**

***(Add Clauses as follows)***

2.1.5 All piping for reservoir and controls building will be Schedule 10 Type 304L Stainless Steel, IPS outside diameter, to ASTM A312/A312M, AWWA C220, and ASTM A778.

**2.2 MAINLINE PIPE, JOINTS, AND FITTINGS**

***(Add Clauses as follows)***

**2.2.7 Stainless Steel Pipe**

- .1 All stainless steel fittings shall conform to ANSI/AWWA C226, ASTM A403, and ASTM A774.
- .2 Stainless steel fabricated specials and fittings shall be fabricated based on the design criteria, fabrication code and equal specifications for original fittings. Reinforcement shall be provided where required to accommodate system

operating pressures. Design standard shall be to AWWA C226 and thickness of all reinforcement collars and pads will be determined by the appropriate formula in the latest edition of ASME B31.3

.3 Flanges:

.1 Flanges to be rated for 150 lbs. Stainless steel flanges shall be raised face except where connections to flat face flanges where they shall be flat face to match valves and fittings. Flanges shall conform to ANSI B16.5 and B16.1 in drilling and dimension.

.3 Stainless steel flanges shall be to AWWA C228, ASTM A182, ASTM A240, ASTM A774. Flanges to be Type 304L to ANSI CL 150.

.1 Van Stone flanges are not permitted.

**3.17 GENERAL PROCEDURE FLUSHING, TESTING, AND DISINFECTION**

**3.17.7 (Add 3.17.7 as follows)**

There shall be no testing or flushing of temporary and permanent water mains on Fridays, Saturdays, or Sundays.

**3.23 CONNECTION TO EXISTING MAINS**

**3.23.1 (Delete Clause 3.23.1 and replace as follows)**

Connections to existing waterworks will be made by the *Contractor*. *District Staff* to be onsite during connections.

.1 Contractor to provide District with 1 week advanced notification for tie in.

**3.23.2 (Add Clause 3.23.2 as follows)**

Provide written notification to all affected residents a minimum of **48 hours** prior to service interruption. Service interruptions must be minimized.

**3.23.3 (Add Clause 3.23.3 as follows)**

Fittings used for the tie ins should be cleaned of foreign material and sprayed with a 1% sodium hypochlorite solution prior to assembly.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

## **1.0 GENERAL**

- .1 Section 33 69 00 refers to those portions of the work that are unique to the supply and installation of the Glass Fused Bolted Steel Tanks, associated foundations, final site grading, internal ss piping, and piping connections. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.
- .2 All details of reservoir facilities not specifically covered in this section to comply with ASTM and CGSB standards and/or manuals of practice as specified in Contract Documents.
- .3 All internal stainless steel pipe works and site grading to meet MMCD Platinum Edition Vol II (2009), including most recent updates/revisions.

Contractor to refer to Drawings C010, C310, C311 for piping connections and site layout/grading.

- .4 All required labour, materials, equipment, and construction services shall be included.

## **1.1 RELATED WORKS**

- |  |                    |
|--|--------------------|
| .1 Concrete Reinforcement                | Section 03 20 01   |
| .2 Cast-in-Place Concrete                | Section 03 30 53   |
| .3 Aggregates and Granular Materials     | Section 31 05 17   |
| .4 Reshaping Existing Subgrade           | Section 31 22 16.1 |
| .5 Excavating, Trenching and Backfilling | Section 31 23 01   |

## **1.2 QUALIFICATIONS OF TANK SUPPLIERS**

- 1 The tank manufacturer shall have specialized in the design and fabrication of factory coated Glass-Fused to Steel NFPA 22 compliant steel bolted tanks for at least ten years prior.

- .2 The tank supplier shall provide a reference list of five (5) NFPA 22 tanks presently used in fire water protection service of equal or greater size than that described herein in service for a minimum of 10 years in British Columbia.
- .3 The manufacturer shall have an active ISO-9001 registration. All engineering design, fabrication and coating shall be done in-house.
- .4 The tank installer shall be certified by the tank manufacturer to be qualified to do the work.

#### **1.4 SUBMITTALS**

- .1 The tank supplier is required to furnish, for the approval of the Engineer, complete specifications, general arrangement drawings and construction drawings in electronic format. Structural calculations shall be provided for the tank and roof structure, and concrete foundation, stamped by a registered professional engineer licensed in the Province of British Columbia.
- .2 Once approved by the Engineer, the submittal information shall be returned to the Bidder and these drawings will govern the work detailed thereon.
- .3 The tank manufacturer's standard published warranty and installation manual shall be included.
- .4 The tank manufacturer's standard Operation and Maintenance Manual shall be included upon receipt of approved drawings.

#### **1.5 MEASUREMENT AND PAYMENT**

- .1 Payment for Glass Fused Bolted Steel Reservoir will include design sealed by an engineer certified in BC, supply, Fabrication, Delivery, and Construction of reservoir works as specified herein and on the contract drawings, and shall be Lump Sum.
- .2 Payment for internal piping shall be separate from tank and foundation and shall be Lump Sum.

#### **2.0 DESIGN CRITERIA**

##### **2.1 CRITERIA**

- .1 TANK CAPACITY AND ELEVATION:
  - .1 New Fort Rupert Reservoir

- .1 Tank capacity: 2,000 m<sup>3</sup>
- .2 Base Elevation: 72.5 m Geodetic
- .3 Max High Water Level: 84m Geodetic
- .2 Replacement Water Treatment Reservoir
  - .1 Tank Capacity: 2,700 m<sup>3</sup>
  - .2 Base Elevation: 119.6m Geodetic
  - .3 High Water Level: 128.6m Geodetic
- .2 TANK DESIGN STANDARDS
  - .1 Materials, design, fabrication, and construction of the bolted steel tank shall conform to the NFPA Standard for “Standard for Water Tanks for Private Fire Protection” – NFPA 22, latest edition.
  - .2 Materials, design, fabrication, and construction of the aluminum dome roof shall conform to the AWWA Standard for “Aluminum Dome Roofs for Water Storage Facilities” – ANSI / AWWA D108, latest edition.
  - .3 The tank coating system shall conform to Section 12.4 Glass Coatings of ANSI / AWWA D103, latest edition.
  - .4 Wind load shall be designed to the latest revision of NBC with an importance factor of “post disaster”, of AWWA D103, whichever is higher.
  - .5 Seismic and snow loads shall be designed to the latest revision of NBC, with an importance factor of “post disaster”.
- .3 TANK FOUNDATION
  - .1 The tank foundation design shall be provided by the tank supplier, based on the soil bearing capacity as detailed in the geotechnical report.
    - .1 Fort Rupert Reservoir geotechnical report attached.
    - .2 WTP Reservoir site geotechnical report to be provided by Contractor of Contract 1 – Port Hardy Watermain Construction within 4 weeks of contract signing.

## 2.2 MATERIALS AND CONSTRUCTION

### .1 BOLTS

- .1 Heads on bolts used in tank lap joints (structure bolts) shall be completely encapsulated by high impact, UV resistant material.
- .2 Structure bolts shall be zinc mechanically deposited in accordance with latest edition of ASTM B695, class 50, type 1.
- .3 Structure bolts on the tank shell shall be installed such that the head portion is located inside the tank, and the washer and nut on the exterior.

### .2 SEALANT

- .1 Sealant shall be one component, moisture cured, polyurethane compound certified by AWWA for potable water use.

### .3 NSF 61

- .1 All materials (encapsulations, sealants, coatings, concrete, etc.) in contact with potable water shall meet requirements of ANSI / NSF Standard 61 and AWWA.

### .4 CATHODIC PROTECTION

- .1 A passive cathodic protection system shall be designed and supplied by the tank manufacturer based upon information supplied by the Engineer or Owner.

### .5 GEODESIC DOME ROOF

- .1 All structural frame members shall be made from AA6005A-T6, or AA6061-T6.
- .2 Roof panels shall be made from AA3003-H16.
- .3 Fasteners shall be AA2024-T4 aluminum or series 300 stainless steel as required by the manufacturers.
- .4 Design sealant will be silicone, conforming to Federal Specification TT-S-0023.
- .5 Gaskets shall be silicone, conforming to Federal Specification ZZ-R-765, Class 2, Grade 50 or equal, or neoprene, conforming to ASTM C509-00.

## 2.3 GLASS COATING

- .1 All structural sheet steel shall be glass coated per the following guidelines.



- .2 Sheets shall be media blasted on both sides to the equivalent of SSPC SP-10 (Near White Metal Blast Cleaning). After fabrication and prior to application of the coating, all sheets shall be thoroughly cleaned by washing and hot rinsing followed immediately by hot air drying.
- .3 A base coat of glass frit containing nickel oxide shall be applied to both sides of the sheet.
- .4 A second coat of milled cobalt blue glass shall be applied to both sides of the sheets.
- .5 A third coat of glass shall be applied to all interior shell and floor sheet surfaces which must be a titanium dioxide reinforced mixture, white glass.
- .6 The sheets shall be fired at a minimum temperature of 816 °C.
- .7 Edge Coat: Prior to sheet glassing, sheet edges shall be rounded in profile per Porcelain Enameling Institute Technical Manual to enable the same glass coating to be applied to all four edges of the sheet and ensure full encapsulation of the sheet edges with a minimum thickness of 5 mils. Sealer or glass overspray as edge coating shall not be an acceptable alternative. As proof, tank supplier shall provide its edge coating procedure with bid for owner approval.
- .8 Frits shall be individually tested in accordance with the latest revision of ISO 28706.
- .9 Holiday Testing: A volt test is performed on every sheet. Any sheet registering a discontinuity on the interior surface or floor shall be rejected.
- .10 Glass Thickness: Minimum glass thickness on the inside surface of the sheet shall be 10.0 mils. Glass thickness shall be measured using a calibrated magnetic induction type electronic dry film thickness gauge.
- .11 Adherence: The coating shall be tested in accordance with ISO 28765 Class 2 or better. Any sheet that has poor adherence shall be rejected.
- .12 Fish Scale Testing: The coating shall be tested for fish scale by placing full size production sheets in an oven at 204 °C for one hour. The sheets will then be examined for signs of fish scale. Any sheet exhibiting this characteristic will be rejected and the entire lot tested.

## 2.4 PACKAGING

- .1 All sheets shall be protected from damage during shipment. Prior to packing, the sheets will be kept separated, or heavy paper / plastic foam sheets will be placed between each panel to eliminate sheet-to-sheet abrasion.
- .2 Individual stacks of panels (not applicable to panels shipped in racks) will be wrapped in heavy mil plastic and steel banded to special wood pallets built to maintain the roll-radius of the tank panels and minimize contact or movement of finished panels during shipment.

## 2.5 TANK STRUCTURE

- .1 GEODESIC DOME ROOF
  - .1 The roof shall be constructed of non-corrugated triangular aluminum panels which are sealed and firmly clamped in an interlocking manner to a fully triangulated aluminum space truss system of wide flange extrusions, thus forming a dome structure.
  - .2 The dome shall be clear span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring.
  - .3 The dome and tank shall be designed to act as an integral unit. The tank shall be designed to support an aluminum dome roof including all specified live loads.
- .2 CONCRETE BOTTOM
  - .1 The bottom design is of reinforced concrete with an embedded steel base setting ring per the manufacturer's design and in accordance with latest edition of AWWA D103.
  - .2 A leveling plate assembly consisting of two anchor rods and a slotted plate shall be used to secure the base setting ring, prior to encasement in concrete. Installation of the base setting ring on concrete blocks or bricks, using shims for adjustment, is not permitted.
  - .3 Place one butyl rubber elastomer waterstop seal on the inside surface of the base setting ring below concrete floor line. Place one bentonite impregnated water seal below the butyl rubber seal. The materials shall be installed in accordance with tank manufacturer's instructions.

## 2.6 PIPE – STAINLESS STEEL

- .1 All internal piping shall be stainless steel schedule 10 type 304L, IPS outside diameter, to ASTM A312M, AWWA C220, and ASTM A778.
- .2 Inlet, discharge, drain and other connections shall conform to the sizes and locations specified on the contract drawings.

## 2.7 APPURTENANCES

### .1 OUTSIDE TANK LADDERS

- .1 An outside tank ladder, complying with the local Occupational Health and Safety Regulations, shall be furnished and installed as shown on the contract drawings. The ladder shall be fabricated of aluminum or galvanized steel. Ladders shall be equipped with a hinged lockable entry device at grade.
- .2 The safety cage and platforms (as required by local Occupational Health and Safety Regulations, or contract drawings) shall be fabricated of aluminum or galvanized steel. A self-closing double-bar safety gate shall be provided at each ladder opening on elevated platforms.

### .2 SHELL MANHOLES

- .1 Two shell manholes shall be provided as shown on the submittal drawings in accordance with the latest revision of AWWA D103.
- .2 The manhole opening shall be a minimum of 610 mm in diameter. The access door and the tank shell reinforcing shall comply with AWWA D103 latest edition.

### .3 ROOF VENT

- .1 A roof vent with a 10-mm minimum corrosion resistant screen is required. Venting area shall be at least 150% of the area of largest inlet or discharge pipe.

### .4 ROOF HATCH

- .1 The manufacturer shall furnish a roof opening which shall be placed near the outside tank ladder. It shall be equipped with a hinged cover and a hasp for locking and have a clear dimension of at least 610 mm in one direction and 381 mm in the other direction. The opening shall have a curb at least 102 mm in height, and the cover shall have a downward overlap of at least 51 mm, or a gasketed weather-tight cover in lieu of the 102 mm curb and 51 mm overlap.

.5 LEVEL INDICATOR

- .1 The tank shall be equipped with a bracket for water level indicator. Supply and attachment by Contractor through contract 1.

.6 EXTERNAL ATTACHMENTS

- .1 External attachments including grounding lugs, cable tray clips, etc. shall be as shown on the contract drawings, or per manufacturer's standard.
- .2 Contractor to reinstate catwalk access between two reservoirs

.7 IDENTIFICATION PLATE

- .1 A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior shell at a location approximately 1.5 m from grade elevation in a position of unobstructed view.

.8 STATIC MIXER (INLET)

- .1 Refer to Supplemental Specification 33 69 10

**3.0 EXECUTION**

**3.1 RESERVOIR CONSTRUCTION**

- .1 Field erection of the bolted steel tank shall be in accordance with the procedures outlined in the manufacturer's assembly manual and performed by an authorized installer of the tank manufacturer.
- .2 The correct manufacturer approved jacks and / or scaffolding specific to the tank type shall be used for assembly.
- .3 Particular care will be taken to protect the coated sheets from damage during field installation. Prior to assembly all surfaces shall be visually inspected and any damaged panels or components repaired or replaced. Any coating damage shall be repaired per manufacturer's recommendations.
- .4 No backfill shall be placed against the tank shell without prior written approval and instructions of the tank manufacturer.
- .5 In accordance with NFPA 22, field welding is not permitted.

### 3.2 PREPARATION FOR WELDING

- .1 The majority of stainless steel welding shall be in an approved fabrication shop that is set up to handle, fabricate and weld stainless steel using handling procedures that are designed to eliminate carbon contamination of the stainless steel. Such procedures shall include the use of stainless steel tools for preparing welds including wire brushes, chisels, files and hammers, welding gloves and grinding wheels used during the fabrication of stainless steel shall not have been used on previous carbon steel work
- .2 Stainless steel shall not be grooved.
- .3 Only 300 series stainless steel brushes or wheels shall be used on austenitic and nickel alloys. Areas used for the fabrication or austenitic and nickel alloys shall be separated from carbon steel areas by methods suitable to prevent contamination of carbon steel shavings, grinding dust and zinc dust from painting operations.
- .4 Where tape is used for backing purge gas the tape shall use an adhesive backing that allows for the complete removal of the tape.
- .5 Shop fabrication fittings made from rolled stock shall be in accordance with ASTM A240 shall be in a solution annealed condition. Shop fabricated fittings made from pipe shall be in accordance with AWWA C22, ASTM A312, ASTM A778. Design standards shall be in accordance with AWWA C226 and the thickness of all reinforcement collars and pads will be determined by the appropriate formula in the latest addition of ASME B31.3.

### 3.3 STAINLESS STEEL WELDING

- .1 All welding of the root pass of austenitic stainless steel pipe shall be done using the GTAW or GMAW process with appropriate filler metal and shielding gas.
- .2 Fabricator to provide the Engineer with a welding procedure prior to commencing any work.
- .3 Fabrication code shall be in accordance with ASME B31.3 and Inspection code shall be Normal Fluid Service (NFS). Shop visual inspection required at beginning of fabrication. Fabricator may be required to undertake 5-10% radiography of welds prior to installation (based on visual inspection and at discretion of the Engineer).
- .4 All shop fabrication welding to be TIG type welding.
- .5 Field welding shall be kept to a minimum and performed only with the prior consent of the engineer. Field welds to be MIG type welding. Welding shall not be performed when the quality of the completed weld would be impaired by the weather conditions. All

welding shall be ceased until suitable protection can be erected. The Contractor will not be compensated for such delays. When ambient temperature is below 0°C, all welding shall cease until an appropriate welding procedure has been qualified and approved by the Engineer.

- .6 All stainless steel welds shall be pickled in accordance with AWWA C220, ASTM A380 and ASTM A967. Pickling paste shall be NSF certified. Any noticeable discolouration found on the stainless steel pipe shall be removed by pickling. Once sufficient pickling time has elapsed, the passivated surface shall be cleaned of all acids by thoroughly rinsing the pipe.
- .7 All welders shall be qualified for the particular welding procedure they will perform.
- .8 Tolerances:
  - .1 Fabricating tolerances for pipe fittings and assemblies shall conform to the Pipe Fabrication Institute.
  - .2 Pipe diameter shall be true to dimensions and roundness for fabricated pipe. All other schedule pipe shall be as appropriate ASTM or AWWA specification.
  - .3 Pipe straightness as measured at mid-point of length of pipe.

### **3.4 DELIVERY HANDLING AND STORAGE OF STAINLESS STEEL**

- .1 During loading, transporting and unloading, care shall be exercised to prevent damage to the pipe and fittings. All damaged materials shall be replaced at the contractor's expense. The material shall be stored clear of the ground surface to prevent dirt from entering or otherwise contaminating the pipe joints.
- .2 The pipe interior shall be inspected prior to assembly and any foreign matter shall be removed. The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water or other foreign matter.
- .3 Fabricated pipe sections being stored or shipped have wooden plugs or plastic caps securely installed in each in order to prevent the pipe ends from being deformed out of round.
- .4 Flanged ends of each fabricated piece shall be protected with wooden fabricated blanks.
- .5 Fabricated pipe sections shall be stored in a manner that will prevent them from being damaged or contaminated with carbon steel during storage.

### 3.3 COMMISSIONING

#### .1 HYDROSTATIC TESTING

- .1 Following assembly and cleaning of the tank, the tank shall be tested for liquid tightness by filling tank to its overflow elevation. Any leaks shall be corrected in accordance with the manufacturer's recommendations.
- .2 Water required for testing shall be furnished by the Owner at the time of tank erection completion. Disposal of test water shall be the responsibility of the Owner.

#### .2 DISINFECTION

- .1 The tank structure shall be disinfected at the time of testing by chlorination in accordance with AWWA Standard C652. Acceptable methods of chlorination shall be chlorination method 1, 2 or 3 as outlined in AWWA C652.

### 3.4 WARRANTY

#### .1 STANDARD WARRANTY

- .1 The tank manufacturer shall warrant the tank will be free from defects in workmanship and materials, under normal and proper use, maintenance, and operation, during the period expiring on the earlier of:
  - .1 five years after liquid is first introduced into the tank, or
  - .2 62 months after a substantial portion of the tank sheets is delivered to site where the tank is erected, if the tank is purchased with the tank manufacturer's cathodic protection system.
- .2 The Contractor shall warranty the piping, valves, fittings supplied and installed by the contractor against any defects in workmanship and materials for a period of one (1) year from the date of substantial completion. In the event any such defect should appear, it should be reported in writing to the manufacturers during the warranty period.

#### .2 EXTENDED WARRANTY

- .1 The tank manufacturer shall offer a ten (10) year extended warranty on the tank, starting from the date of installation, provided the following conditions are met:
  - .1 The tank shall only be used for the storage of fire water. This extended warranty shall void and terminate if the tank is used for any other liquid.

**These Supplementary Specifications must be read in conjunction with the Master Municipal Specifications contained in the Master Municipal Construction Documents, Volume II, Platinum Edition 2009, including all updates and revisions. In instances where clauses within the Supplementary Specifications and MMCD documents disagree/differ the Supplementary Specifications shall govern.**

## **1.0 GENERAL**

- .1 Section 33 69 10 refers to those portions of the work that are unique to the supply and installation of the Hydrodynamic Mixing System (HMS).
- .2 The HMS is defined as a supplemental system installed within a potable water storage reservoir which passively utilizes the energy provided by the inlet water supply and generates a sufficient inlet momentum to achieve a complete homogeneous blending of the water volume within the reservoir with the inlet supply flow. Determination of Complete Homogeneous Blending shall be defined by the modeling requirements and supporting hydraulic analysis as conducted by each individual manufacturer for their specific system configuration as defined within these specifications. System submittals not providing this validation shall not be considered as a viable HMS and shall not be accepted as an equivalent to this system specification.
- .3 The specifications in this section include all components of the Reservoir HMS consisting of a bi-directional flow manifold equipped with variable orifice duckbill inlet nozzles and outlet flow check valves that are NSF61 certified. The HMS manufacturer shall be responsible for designing the system in accordance with the hydrodynamic criteria defined within these specifications and submit design calculations verifying compliance in accordance with the submittal requirements.
- .4 All modeling and hydraulic and mixing calculations pertaining to the HMS shall originate from the duckbill valve manufacturer. Modeling and calculations provided by parties other than the duckbill valve manufacturer are not allowed.
- .5 The complete HMS shall be supplied by the variable orifice nozzle manufacturer to maintain single source responsibility for the system. The complete system shall be defined as all piping and appurtenances within the tank downstream of the tank penetration. Appurtenances include pipe, fittings, horizontal and vertical pipe supports, expansion joints, variable orifice duckbill check valves, and any other equipment specified within this section of the specifications.
- .6 Manufacturer's and/or contractors submitting an alternative to the approved manufacturers mixing systems shall be responsible for obtaining any and all proprietary rights, license fees, royalties, technology licenses, and/or permissions required to provide such a system. The Manufacturer shall indemnify and hold harmless the Owner and Engineer against all claims, damages, losses, and expenses arising out of any infringement of patent rights or copyright incident relating to this system.



## 1.1 Related Works

- .1 Glass Fused Bolted Steel Reservoir Section 33 69 00

## 1.2 Reference Standards

### American National Standards Institute (ANSI)

B16.1 – Cast Iron Pipe Flanges and Flanged Fittings

B16.5 – Pipe Flanges and Flanged Fittings

B36.10 – American National Standard Weights and Dimensions of Welded and Seamless Wrought Steel Pipe

### American Society for Testing and Materials (ASTM)

A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel, Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A351 – Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts

A536 – Standard Specification for Ductile Iron Castings

C110 – Ductile Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water

D1330 – Standard Specification for Rubber-Sheet Gaskets

D1784 – PVC/CPVC Pipe Compounds

D1785 – PVC Pipe, Schedules 40, 80 & 120

D2466 – PVC Solvent Cement

D2855 – PVC Solvent Joints

D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings

D3915 – PVC Pipe Fitting Compounds

American Iron and Steel Institute (AISI)

AISI 304 – 304 Stainless Steel Plate

AISI 316 – 316 Stainless Steel Plate

AISI 1040 – Carbon Steel Plate

American Water Works Association (AWWA)

C104 – Cement-Mortar Lining of Ductile Iron Pipe and fittings for Water

C110 – Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water

C115 – Flange Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges

C200 - AWWA Standard for Steel Water Pipe 6" and Larger

C207 – Standard for Steel Pipe Flanges for Waterworks Service – Size 4 In. to 144 In.

C220 – AWWA Standard for Stainless Steel Pipe, 4" and Larger

C900 – AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. for Water Distribution

C905 – AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In Through 48 In. for Water Transmission and Distribution

C906 – AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In. for Water Distribution

American Water Works Association Research Foundation (AWWARF)

Project No. E20-J08 – Physical Modeling of Mixing in Water Storage Tanks  
(Forthcoming)

National Sanitation Foundation (NSF)

NSF Standard 14 – Plastic Piping System Components and Related Materials

NSF Standard 61 – Drinking Water System Components – Health Effects

### 1.3 Measurement and Payment

- .1 Payment for hydraulic static mixer will include design sealed by an engineer licensed in British Columbia, Fabrication, Supply, Delivery and Construction as specified herein and on the contract drawings and shall be Lump Sum.

### 2.0 Variable Orifice Duckbill Inlet Nozzles

- .1 Inlet ports/nozzles shall be duckbill-style check valves that allow fluid to enter the reservoir during fill cycles and prevent flow in the reverse direction through the nozzle during draw periods. Inlet ports/nozzles may not be fixed-diameter ports or pipes.
- .2 The duckbill valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.
- .3 Inlet ports/nozzles shall have a variable diameter vs. flow hydraulic profile that provides a non-linear jet velocity vs. flow characteristic and a linear headloss vs. flow characteristic. The hydraulic characteristics of the duckbill valves shall be defined by "Hydraulic Code".
- .4 The inlet ports/nozzles shall discharge an elliptically shaped jet. The nozzle must have been modeled by an independent laboratory using Laser Induced Fluorescence (LIF).
- .5 Manufacturer shall have conducted independent hydraulic testing to determine headloss and jet velocity characteristics on a minimum of eight (8) sizes of duckbill valves ranging from 2" through 48". The testing must include multiple constructions (stiffness) within each size and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions.
- .6 Manufacturer shall have conducted an independent hydraulic test where multiple valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability of the manufacturing process to produce the same hydraulic characteristics.
- .7 Manufacturer shall have conducted independent hydraulic testing to study the flow distribution characteristics of duckbill valves installed on multiport manifolds.
- .8 Manufacturer to have conducted Finite Element Analysis (FEA) on various duckbill valves to determine deflection, stress, and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure.
- .9 Manufacturer must have conducted in-house backpressure testing on duckbill valves ranging from ¾" to 48".

- .10 Manufacturer shall have at least fifteen (15) years' experience in the manufacturing of "duckbill" style elastomeric valves.
- .11 Manufacturer must have duckbill valves installed on manifold piping systems in at least 100 distribution system reservoirs.
- .12 Manufacturer must have representative inspection videos showing the duckbill valves discharging water into the reservoir during an initial fill (unsubmerged). Manufacturer must also have representative underwater inspection videos showing the operation of the valves when submerged. Representative videos shall be submitted to the engineer on CD-ROM for review.
- .13 The duckbill style nozzles shall be one-piece elastomer matrix with internal fabric reinforcing designed to produce the required discharge velocity and minimum headloss requirements as stipulated in the Submittals section. The flange portion shall be an integral portion of the nozzle with fabric reinforcing spanning across the joint between the flange and nozzle body.
- .14 The elastomer used in construction of the duckbill valves must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."
- .15 The manufacturer's name, plant location, serial number and product part number which designates nozzle size, material and construction specifications shall be bonded onto the surface of the nozzle

### **3.0 Outlet Check Valves**

- .1 The outlet flow valves shall be perforated disc type with elastomeric membrane.
- .2 The valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.
- .3 The perforated disc shall be fabricated of stainless steel plate with welded support gussets. The disc shall be flanged and drilled to mate with ANSI B16.1, Class 125/ANSI B16.5 Class 150 flanges. The disc shall have three (3) tapped holes used for fastening the membrane and support rod to the disc with stainless steel bolts, nuts, and lock washers. The top of the disc shall be tapped and supplied with lifting eyebolt for installation.
- .4 The membrane shall be circular, one piece rubber construction with fabric reinforcement. The diameter of the membrane shall allow adequate clearance between the membrane O.D. and the pipe I.D. The membrane shall be vulcanized with a specified convex

- radius to produce a compression set to allow the membrane to seal against the perforated disc at low reverse differential pressure.
- .5 The support rod shall be stainless steel and drilled with three (3) longitudinal holes to allow fastening of rod to membrane and perforated disc.
  - .6 When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the membrane to open, allowing flow to pass through the perforations in the disc. When backpressure exceeds the line pressure, the membrane seats on the perforated disc preventing backflow.
  - .7 The valve allows flow out of the reservoir during draw cycles and prevents flow into the reservoir during fill cycles.
  - .8 The elastomer used in construction of the membrane must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."
  - .9 The manufacturer's name, plant location, serial number and product part number which designates membrane size, material and construction specifications shall be bonded onto the surface of the membrane

#### **4.0 Stainless Steel Pipe and Fittings**

- .1 Stainless steel pipe and fittings shall conform to the associated standards listed in Section 1.2: Reference Standards.
- .2 Dimensions for stainless steel fittings shall conform to AWWA C110, unless otherwise specified.
- .3 Piping shall be Schedule 10s stainless steel 304L fabricated from material per ASTM-A240.
- .4 All flanges shall be plate ring flanges. Flange drilling pattern shall be in accordance with ANSI B16.1/B16.5 standards.
- .5 Ring flanges shall be continuously welded on both sides.
- .6 All shop welds shall be manually scrubbed or brushed with non-metallic pads or stainless steel wire brushes to remove weld discoloration. Welds to be chemically passivated with nitric or citric acid.
- .7 Field welding of stainless steel pipe and fittings will not be allowed unless approved by the Engineer.

**5.0 Flange Gaskets**

- .1 Flange gaskets shall be full-faced and shall be in accordance with ASTM D1330.
- .2 Flange gasket drilling pattern shall conform to ANSI B16.1/B16.5.
- .3 Flange gaskets shall be 1/8" thick.
- .4 Gasket material shall be EPDM

**6.0 Fasteners**

- .1 Hex head bolts and nuts shall be stainless steel 316 conforming to ANSI/ASME B18.2.1 and ANSI/ASME B18.2.2.
- .2 Plastic insulating sleeve/washers shall be utilized to isolate dissimilar bolt and flange metals where required

**7.0 Pipe Supports**

- .1 All components of the bracket assembly shall be stainless steel 304 in accordance with the associated standards.
- .2 The bracket assemblies shall consist of four components (all stainless):
  - .1 A base plate (when required). For the concrete base/foundation, the base plate will have four thru holes for expansion anchors.
  - .2 A top-works weldment that consists of structural channel and angle stock. The HMS piping shall rest on the angle stock. The angle stock has predrilled holes for the U-bolt.
  - .3 U-bolt with four hex nuts.
  - .4 An 1/8" thick EPDM strip with a length equivalent to the circumference of the pipe. The strip shall be placed between the pipe and the angle stock and U-bolt.
- .3 The channel of the top-works weldment shall be field fit and modified to the required length. The channel shall then be field welded to the base plate.
- .4 Plastic insulating sleeve/washers shall be utilized to isolate dissimilar metals where required.

## 8.0 Coatings

- .1 Following installation of the manifold system, all carbon steel and ductile iron pipe, fittings, bolted connections, pipe supports, and appurtenances shall be coated according to the interior tank paint specification as specified by the tank manufacturer.
- .2 Surface preparation and coating procedures shall be provided by the tank manufacturer and the coating supplier to the Engineer for review/approval.
- .3 **Valves shall not be coated.** The valves shall either be masked or be mounted after coating of the tank and piping. Contractor to ensure masking materials are removed after coating.

## 9.0 Delivery, Storage, and Material Handling

- .1 Individual nozzles and outlet valves shall be packaged separately from the piping equipment.
- .2 All flanges shall be protected by using plastic inserts or plank wood, pipe sections are to be fully supported to prevent pipe deflection or damage to fittings or connections.
- .3 All equipment shall be shipped on pallets capable of fully supporting the pipe sections across their entire length. Pallets should be accessible for fork lift transport or strap and hoist means without causing any load to the pipe equipment.
- .4 All stainless-steel components shall be stored separately away from any carbon steel components or other materials that could stain or deface the stainless-steel finish from run-off of oxidized ferrous materials.
- .5 All pipe equipment should be covered and stored in areas free from contact with construction site sediment erosion to prevent accumulation of materials within the pipe and fittings.
- .6 Duckbill nozzles should be protected from contact with rigid objects during handling and storage. The contractor shall be responsible for replacing any duckbill nozzles or elastomeric components that are damaged after arrival on the site through installation and start-up of the system

## 10.0 Submittals

- .1 Independent CFD Modeling Validation
  - .1 The mixing system designer/supplier must supply data or report from at least one project where an independent company conducted CFD modeling on their mixing

system design and the modeling results verified the design achieved complete mixing.

.2 Full Scale Tracer Study Validation

- .1 The mixing system designer/supplier must supply data or report from at least one project where a full-scale tracer study using calcium chloride was conducted on a circular reservoir and the tracer study results verified the mixing system design achieved complete mixing.
- .2 The mixing system designer/supplier must supply data or report from at least one project where a full-scale tracer study using calcium chloride was conducted on an elevated tank and the tracer study results verified the mixing system design achieved complete mixing.

.3 Inlet Nozzle and Outlet Valve Testing and Validation

- .1 Verification of independent hydraulic testing to determine headloss and jet velocity characteristics on a minimum of eight (8) sizes of duckbill valves ranging from 2" through 48". The testing must include multiple constructions (stiffness) within each size and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions.
- .2 Verification of Independent Laboratory Testing for Manufacturing Consistency - the duckbill valve manufacturer shall provide summary documentation of a report conducted by an Independent Laboratory for hydraulic testing where multiple duckbill valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability and consistency of the manufacturing process to produce the same hydraulic characteristics.
- .3 Report of independent testing that studied the flow distribution characteristics of duckbill valves installed on multiport manifolds. The manufacturer must have been in the business of manufacturing duckbill valves at the time the report was published.
- .4 Verification of Finite Element Analysis (FEA) of duckbill valves. The duckbill valve manufacturer shall provide summary documentation of Finite Element Analysis modeling on representative duckbill nozzle sizes to determine deflection, stress and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure.



- .5 Verification of independent hydraulic testing to determine headloss characteristics on a minimum of three (3) sizes of perforated disc/elastomeric membrane check valves ranging from 6" through 36". Testing must have been conducted with and without the membrane installed. At least two (2) sizes shall have tested two (2) different membrane thicknesses.
  - .6 Verification of Finite Element Analysis (FEA) modeling on a perforated disc/elastomeric membrane check valve to determine stress and deflection characteristics under reverse differential pressure.
- .4 Validation of Long-term performance
- .1 The mixing system designer/supplier must supply at least one inspection report showing proper operation of, and no deterioration of, the duckbill valves after being in service in a water storage tank mixing application for a minimum of 10 years.
- .5 NSF61 Certification
- .1 Copy of the NSF61 Certified listing for the valves used in the Hydraulic Mixing System (HMS).
  - .2 The valves themselves must be NSF61 certified, not just the elastomer used in construction of the valves. NSF61 approved/certified materials will not be accepted in lieu of valve certification.
  - .3 The NSF61 Certification for the valves must be for a minimum volume of 2,000 gallons. Valves with NSF61 Certification for minimum volume of greater than 2,000 gallons are not acceptable.
- .6 Test Report on Elastomer Exposure to Chlorine and Chloramine
- .1 Copy of test report from an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."
- .7 System Installation Drawings
- .1 The duckbill valve manufacturer shall be responsible for providing engineering installation drawings of the complete manifold piping system as supplied by the manufacturer. These drawings shall include plan view piping arrangement, sections and elevations as required, support bracket installation details, duckbill nozzle orientation details, and all dimensions required for locating the system within the specified dimensions of the tank.

- .2 Six (6) sets of plans shall be provided to the Engineer for review and approval.
- .3 Two (2) sets of final fabrication and installation drawings shall be included with the shipment of the manifold piping equipment.
- .8 Design Calculations
  - .1 All Design Calculations, curves, and reference information listed below must originate and be submitted by the duckbill valve manufacturer. **Calculations, curves, and reference information provided by contractors relating to the HMS are not allowed.** The duckbill valve manufacturer MUST include within the submittal package the following design calculations, curves, and reference information:
    - .1 Calculations showing the fill time required, under isothermal conditions, for the HMS system to achieve complete mix of the reservoir volume at minimum, average and peak fill rates. Complete mixing defined as 95% homogenous solution. The theory and equations used in calculating the mixing times must be from a published AWWA reference manual or paper. The reference document(s) must be submitted with the equations and calculations.
    - .2 Calculations showing the water level drawdown required to achieve complete mixing on the fill cycles at minimum, average, and peak flow rates.
    - .3 Calculations of average storage tank water age for both fill-then-draw, and simultaneous fill and draw scenarios. Theory used in calculating water age must be submitted with the calculations.
    - .4 A representative Computational Fluid Dynamics (CFD) model evaluation of the proposed HMS system configuration applied within a reservoir of similar geometry. Model output documentation shall include all design variables applied for the simulation, plot of the 3-D geometry showing the mesh definition, velocity magnitude vector and contour plots at different cross-sections throughout the water volume, simulated tracer animations showing the spatial and temporal distribution of inlet water in real time during the fill cycle.
    - .5 Hydraulic calculations showing the resulting jet velocities of each inlet nozzle at minimum, average, and peak fill rates.
    - .6 Hydraulic calculations showing the flow distribution among all inlet ports at minimum, average, and peak fill rates.

- .7 Manifold hydraulic calculations showing the total headloss of the HMS at minimum, average, and peak fill and draw rates. Headloss shall include all minor losses and headloss of nozzles and outlet check valves.
  - .8 Hydraulic curves showing thrust vs. flow for the inlet nozzles.
  - .9 Hydraulic curves for each outlet check valves showing headloss vs. flow.
  - .10 Calculations showing the terminal rise height of the jets that discharge at an angle above horizontal. The terminal rise height shall be calculated assuming 10°F and 20°F colder inlet water and calculated at minimum, average and peak fill rates. The theory and equations used to calculate the terminal rise height shall be included.
  - .11 Hydraulic curves for each inlet nozzle of Densimetric Froude number vs. flow
  - .12 If the calculations and supporting data provided do not show compliance with the hydrodynamic requirements of the system as interpreted by the Engineer or Owner then the submittal shall be rejected.
- .9 Installation, Operation, and Maintenance Manuals
- .1 Within 30 days of final approval of the installation drawings, by the Engineer, the HMS valve manufacturer shall provide four (4) sets of the installation portion of the Installation, Operation and Maintenance (IOM) Manuals for the applicable system. Within 30 days of final approval, by the Engineer, of the installed system the manufacturer shall provide six (6) copies of the complete Installation, Operation and Maintenance (IOM) Manual for final review and approval.
  - .2 The manuals shall be in the following format and include the listed required information as a minimum:
    - .1 Enclosed in a 3-ring binder with project title and system designation shown on the front cover and side binder.
    - .2 Table of contents
    - .3 Copy of design calculations for the manifold system as defined in the previous section.
    - .4 Copy of complete set of the installation plans.
    - .5 Copy of NSF61 Certified Listing for the valves

- .6 Parts and equipment list with specification numbers for ordering of replacement parts.
- .7 Product specification sheets for nozzles, outlet valves, expansion joints, concrete anchors, and any other specialized items supplied with the system.
- .8 Installation guidelines for the HMS manifold system.
- .9 Operational procedures for the HMS manifold system.
- .10 Guidelines for repair of system components.
- .11 Schedule for suggested periodic maintenance of the manifold system.

### **11.0 Installation**

- .1 Installation of the manifold system shall be in accordance with the installation plans and guidelines provided by the HMS manufacturer and as specified in the installation section of the IOM manual. Refer to section on Submittals for quantities and delivery schedules of the documents

### **12.0 Installation Inspection and Start-Up Testing Procedures**

- .1 The HMS manufacturer's authorized representative shall provide one (1) day onsite inspection to verify that the system has been installed in accordance with the design specifications and installation drawings.
- .2 Start-Up Flow Testing
  - .1 Following installation of the complete manifold piping system, the contractor shall open the upstream isolation valve to allow flow into the tank through the manifold system. The isolation valve must be opened slowly to prevent surge or over-pressurization of the manifold system. The isolation valve must be fully opened to inspect the flow characteristics of the manifold system.
  - .2 The contractor and factory representative shall visually inspect the entire piping system for leakage.
  - .3 The contractor and factory representative shall visually inspect all of the inlet nozzles to ensure flow is being discharged into the tank through all nozzles proportionately.

### **13.0 Spare Parts**

- .1 Spare parts are not required

**14.0 Warranty**

- .1 The complete manifold piping system shall be supplied by the HMS manufacturer to maintain single source responsibility for the system. The complete system shall be defined as all piping and appurtenances within the tank downstream of the tank penetration. Appurtenances include pipe, fittings, horizontal and vertical pipe supports, expansion joints, duckbill valves, and any other equipment specified within this section of the specifications.
- .2 All piping, pipe support brackets, joint connections, expansion joints, and anchors shall be warranted by the HMS manufacturer against failure under design conditions for a period of one (1) year from the date of final installation approval by the Engineer.
- .3 Inlet nozzles and outlet valves shall be warranted by the manufacturer against failure under design operating conditions for a period of one (1) year from the date of final installation approval by the Engineer. Elastomer components damaged as a result of maintenance activities, foreign debris, or excessive exposure to direct ultraviolet and thermal radiation shall be excluded warranted coverage.