

Section	Title	Pages
01 11 00	Summary of Work	5
01 31 19	Project Meetings	2
01 33 00	Submittal Procedures	6
01 35 29	Health and Safety Requirements	4
01 35 43	Environmental Requirements	7
01 41 00	Regulatory Requirements	6
01 45 00	Quality Control	4
04 45 01	Quality Assurance	18
01 51 00	Temporary Utilities	5
01 52 00	Construction Facilities	6
01 56 00	Temporary Barriers and Enclosures	3
01 61 00	Common Product Requirements	6
01 73 00	Execution	3
01 77 00	Closeout Procedures	5
06 10 00	Rough Carpentry	6
09 91 99	Painting for Minor Works	5
26 05 00	Common Work Results for Electrical	5
31 00 00	Earthworks – Short Form	4
33 11 16	Incoming Site Water Utility Distribution Piping	3
33 16 16	Underground Potable Water Cistern	2
40 23 01	Water Process Piping, Valves and Fittings	39
40 24 00	Chemical Systems, Piping, Valves and Fittings	12
40 80 00	Commissioning of Process Systems	5
43 21 39	Submersible Well Pump	11
46 00 00	Water Treatment Equipment General Requirements	17
46 30 00	Chemical Feed Equipment	7
46 61 53	Filters – Cartridge Type	4
Appendix - Drawings	Site Plan	1
Appendix – Drawings	Water Shed Equipment Layout	1
Appendix – Drawings	Water Utility Shed Drawings	2

## PART 1 - GENERAL

- |   |    |  |
|---|----|--|
| <u>1.1 PROJECT DESCRIPTION</u>                | .1 | The project is the supply and installation of a 5000 imperial gallon fresh water cistern and micro-chlorination system to supply the Visitor Orientation Centre (VOC) with potable water on a continuous basis. The work is to include all necessary equipment and materials that are associated with a system of this type.   |
| <u>1.2 PROJECT LOCATION</u>                   | .1 | The project is located at the Bar U Ranch National Historic Site, which is located 13 km south of the town of Longview on Hwy 22.  |
| <u>1.3 CONTRACT METHOD</u>                    | .1 | Construct Work under a single stipulated price contract.   |
| <u>1.4 WORK COVERED BY CONTRACT DOCUMENTS</u> | .1 | <p>The work covered under these contract documents includes the following:</p> <p>.1 Supply and install a 5000 imperial gallon cistern, micro chlorination system, and associated piping and equipment to ensure a continuous supply of potable water to the VOC. The cistern will be supplied with potable water that will be trucked in from the town of Longview. However, in the future a local water source for raw water may be brought on line and raw water pumped to the cistern but this scenario is uncertain at this time. The cistern, micro chlorination system, and associated piping, equipment, and controls will have the following parameters associated with it:</p> <ol style="list-style-type: none"> <li>1. The cistern is to be a precast concrete 5000 imperial gallon tank with anti-flotation pad.</li> <li>2. The cistern is to be lined with a self-adhering waterproof membrane compatible with potable water storage.</li> <li>3. The water system installed from the cistern to the VOC is to provide a continuous supply of water with a constant supply pressure of 50-70</li> </ol> |

psi. The pump that will supply the system should be capable of dealing with a static head of 7 m and low flow conditions. The expected flow rates for the system is as

	Imp gal/day	l/day	l/s
Peak Hour	3000	13640	0.16
Max. Day	2000	9090	0.11
Avg. Day	1035	4700	0.05
Min. Day	350	1590	0.02

follows:

4. To provide sufficient chlorine residual in the distributed potable water, it was determined that a micro chlorination system is required. The micro chlorination system is to be designed to maintain chlorine residual levels between 0.5-1.0 mg/l. Due to the low demand conditions; the system is to be an in-line chlorination system with low dosing capabilities to prevent over-dosing during the low demand conditions. Since the stored potable water may contain some residual chlorine (dependent on the storage time in the cistern), in-line chlorine analysis is required to control the chlorine dose. The system should be expandable to take into account increased flows relatively easily should the overall water system be expanded to supply other buildings located on the site in the future.
5. An in-line filter system is required for the water system to provide an additional barrier against solids and sediments that may have entered the cistern system. It is to consist of a three filter cartridge system, installed in series. The filter sizes are to be 10, 5, and 1 micron respectively.
6. The cistern is to be buried at the location shown on the attached site plan. The cistern and associated piping to the VOC shall be buried at a depth that is below the frost penetration level for the site, which is approximately 3m.
7. A wood utility shed with concrete slab on grade is to be constructed above the cistern and will house the pump controls, filters, and micro chlorination system. The water system will then be connected via underground piping to the northeast corner of the VOC as indicated and tied into the existing water system for the VOC in the mechanical room at that location.

8. The utility shed will be an insulated wood shed as shown on the drawings included in the appendix. The size of the shed is 3m x 4m. The utility shed is to be heated and include an exhaust fan for air circulation appropriate to the type of micro chlorination system installed in the building.
9. The water system is to include a monitoring system that has capability to monitor the following:
  - Cistern level (high/low)
  - Pump Failure
  - Chlorine Residual (high/low)
  - Chlorine system failure
  - Chlorine safety alarm(chlorine gas in air if a liquid system is installed)
  - Building temperature (high/low)
  - Building flood (water sensor at bottom of wall)
  - Building security alarm

The system will call out to system operator via telephone or cell phone to alert to a problem.

10. The Contractor will be responsible to design the micro-chlorination system to meet the requirements laid out in these specifications. Process drawings and a list of equipment indicating that the system meets the requirements will be required for approval before installation on site. Should the system not be able to meet the requirements as laid out in the specifications will be corrected by the Contractor to meet the requirements at no cost to the Owner.
11. The Contractor is required to reinstate and make good any grounds that are disturbed as part of the work, including clean-up, top soiling and reseeding as required.

## 1.5 WORK SEQUENCE

- .1 Obtain authorization from the Departmental Representative that work in the Site parking lot area can commence. Interruption of the existing water supply in the VOC must be kept to a minimum as the site will be operational during the time of construction. Impact to the parking area for the site is to be kept to a minimum as well as the site may be operating during the time of construction. Access to the parking lot to the site for the public must be maintained at all times. Only those areas explicitly required to perform the Work shall be cordoned off from the public.

1.6 CONTRACTOR USE  
OF PREMISES

- .1 Unrestricted use of the work area until Substantial Performance.
- .2 Limit use of premise for Work, for storage, and for access, to allow for Public usage
- .3 Coordinate use of premises under direction of Departmental Representative. The Site will be operating a temporary source of potable water for the VOC during the duration of construction. Interruption of the water supply must be coordinated with the Site and kept to a minimum during the daily operations of the building.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative .

1.7 EXISTING  
SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Services will have to be maintained to the VOC during the time of construction. The Departmental Representative will provide information as to what systems and equipment must remain operational during the period of construction.

- .3 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic and Site operations.
- .4 Provide alternative routes for pedestrian and vehicular traffic.
- .5 Establish location and extent of service lines in area of work before starting Work. Contractor is responsible for having locates done for all utilities in the work area and the associated costs in doing the locates. Notify Departmental Representative of findings.
- .6 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures .

#### 1.8 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.

- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety  
Related Documents.
- .11 Other documents as specified.

.1 The work is to be completed by July 30<sup>th</sup>, 2013.

.1 The warranty on all Works constructed as part of  
this contract will be a minimum of 1 year from the  
Final Completion Certificate.

## 1.9 SCHEDULE

## 1.10 WARRANTY

### PART 2 - PRODUCTS

#### 2.1 NOT USED

.1 Not used.

### PART 3 - EXECUTION

#### 3.1 NOT USED

.1 Not used.

---

Bar U Ranch NHS	SUMMARY OF WORK	Section 01 11 00
VOC Cistern		Page 8
BU13-04-013		2013/04/29

---



## **1 GENERAL**

### **1.01 PRECONSTRUCTION MEETING**

- .1 Following Notice of Award, the Departmental Representative will request a pre-construction meeting of the parties to the Contract to discuss and resolve administrative procedures and responsibilities.
- .2 Representatives of the Owner, Contractor, any major Subcontractors, field inspectors, supervisors and surveyors shall be in attendance.
- .3 After the time and location of this meeting has been established, the Contractor shall notify all concerned parties a minimum four days before the meeting.
- .4 The Departmental Representative shall chair and record discussions and decisions and circulate the meeting notes to all parties concerned.
- .5 Agenda to include:
  - .1 Appointment of official representative of participants in the Work.
  - .2 Schedule of Work
  - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
  - .5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures .
  - .6 Traffic and parking control plan
  - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
  - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
  - .11 Monthly progress claims, administrative procedures, photographs, hold backs.
  - .12 Appointment of inspection and testing agencies or firms.
  - .13 Insurances, transcript of policies.

### **1.02 PROGRESS MEETINGS**

- .1 The Consultant shall schedule, chair and administer progress meetings throughout the progress of the Work, as required.
- .2 Representatives of the Contractor, and any Subcontractors and Suppliers attending meetings, must be qualified and authorized to act on behalf of the party each represents.

- .1 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for affect on construction schedule and on completion date.
  - .12 Other business.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 ADMINISTRATIVE**

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed. The list of required submittals is as follows:
  - .1 Construction Schedule (Gantt Chart) in Microsoft Project format
  - .2 Environmental Protection Plan
  - .3 Health and Safety Plan
  - .4 Traffic Management Plan
  - .5 Shop drawings
  - .6 As-builts
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

### **1.02 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Shop Drawings are to clearly indicate materials, methods of construction and attachment of anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to Drawings and specifications. Notify the Departmental Representative in writing of any deviations in shop drawings from the requirements of the Contract Documents. Shop drawings are to be submitted in either electronic or paper format. Electronic drawings must be submitted in PDF format. For paper format, six (6) sets of Shop Drawings are to be provided.
- .2 Shop drawings not stamped, signed and dated by the Contractor will be returned without being reviewed and will be stamped "Re-submit".
- .3 Failure to submit Shop Drawings in a timely manner shall not to be considered sufficient reason for an extension to the Contract Time.
- .4 For paper submissions, submit six (6) copies of white prints and six (6) copies of all fixture cuts and brochures. To submit in electronic format, all information submitted must be in PDF format.
- .5 Shop Drawings will be returned to the Contractor with one of the following notations:
  - .1 When stamped "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.
  - .2 When stamped "REVIEWED AS MODIFIED -PROCEED", ensure that all copies for use are modified and distributed, same as specified for "NO EXCEPTIONS TAKEN".
  - .3 When stamped REVISE & RE-SUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.
  - .4 When stamped "NOT REVIEWED", submit other drawings, brochures, etc. for review consistent with the Contract Documents.
  - .5 Only Shop Drawings bearing "NO EXCEPTIONS TAKEN" or "REVIEWED AS MODIFIED - PROCEED" shall be used on the Work unless otherwise authorized by the Departmental Representative.
- .6 After submittals are stamped "NO EXCEPTIONS TAKEN" or "REVIEWED AS MODIFIED PROCEED", no further revisions are permitted unless re-submitted to the Departmental Representative for further review.
- .7 Any adjustments made on Shop Drawings by the Departmental Representative are not an authorization to change the Contract Price. If it is

considered that such adjustments affect the Contract Price, the Contractor shall clearly state as such, in writing, and obtain the Owner's agreement prior to proceeding with fabrication and installation of work.

- .8 The Contractor shall make changes in Shop Drawings which the Departmental Representative may require that are consistent with the Contract Documents. When re-submitting, notify the Departmental Representative in writing of any revisions other than those requested by the Departmental Representative.

### 1.03 SAMPLES

- .1 Submit samples for the Departmental Representative's review as specified or as the Departmental Representative may reasonably request. Clearly label samples as to origin and intended use in the Work. Reference samples to Contract Documents.
- .2 Submit samples with reasonable promptness and in orderly sequence so as to cause no delay in the Work.
- .3 Notify the Departmental Representative in writing, at the time of submission, of any deviations in samples from requirements of Contract Documents.
- .4 The Departmental Representative's review will be for conformity of design concept and general arrangement only. Such review is not to be considered relief of responsibility for errors or omissions in samples or of responsibility for meeting all requirements of the Contract Documents.
- .5 Make changes in samples which the Departmental Representative may require consistent with Contract Documents.

### 1.04 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

### **1.09 - OPERATING/MAINTENANCE MANUALS**

- .1 Not less than two (2) weeks prior to application for Substantial Performance of the Work, the Contractor shall submit to the Departmental

Representative four (4) printed copies and 1 electronic copy in PDF format of operating and maintenance manuals containing information required by the Specifications. All instructions in the manuals shall be in simple language to guide the Owner in the proper operation and maintenance of the installation.

- .2 For the paper copies, bind contents in a three-ring, hard covered, plastic jacketed binder. Organize contents into applicable sections of work, parallel to Specifications break-down. Name of facility to be embossed onto binder cover.
- .3 In addition to information called for in the Specifications, include the following:
  - .1 Title sheet, labeled "Operation and Maintenance Instructions", and containing project name and date.
  - .2 List of contents.
  - .3 Reviewed Shop Drawings of all equipment.
  - .4 As-built drawings of all mechanical, electrical, control, and alarm installations.
  - .5 Full description of entire mechanical, electrical, control, and alarm system and operation.
  - .6 Names, addresses and telephone numbers of all major Subcontractors and Suppliers.
  - .7 Operating instructions for all equipment.
  - .8 Maintenance instructions for all equipment, including frequency of maintenance tasks.
  - .9 Equipment parts lists.
  - .10 Emergency operating procedures.
  - .11 Certified head/capacity curves for pumps.
- .4 Each section shall be separated from the preceding section with a plasticized cardboard divider with a tab denoting contents of the section.

#### 1.10 RECORD DRAWINGS

- .1 Following Notice of Award, the Departmental Representative will provide a complete set of Contract Drawings for the purpose of maintaining "as-built" record drawings. Accurately record significant deviations from Contract Documents caused by site conditions and changes approved by the Departmental Representative. Update as required and at intervals not exceeding one month.
- .2 Identify drawings as "Project Record Copy". Maintain in good condition and make available for inspection on site by Departmental Representative at all times.
- .3 Not less than two (2) weeks prior to application for Substantial Performance of the Work, submit record drawings to Departmental Representative for review. Record drawings to be in Autocad or PDF format.

#### **1.11 SURVEY NOTES**

- .1 Not less than two (2) weeks prior to application for a Substantial Performance of the Work, submit to the Departmental Representative copies of survey notes containing all information required by the Contract Documents.

#### **1.12 PHOTOGRAPHS AND PUBLICITY**

- .1 No photographs of the site or of any portion of the Work will be permitted without prior approval of the Departmental Representative.
- .2 No press or publicity releases will be permitted. All contact with the press will be redirected to the Departmental Representative.

### **2 PRODUCTS**

#### **2.01 NOT USED**

- .1 Not Used.

### **3 EXECUTION**

#### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Alberta
  - .1 Occupational Health and Safety Act, Updated 2009.

### 1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit one copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and/ or authority having jurisdiction, daily bi-weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.



- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

### 1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial Territorial authorities prior to beginning of Work on behalf of the Parks Canada Agency.

### 1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

### 1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

### 1.6 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with Section 01 41 00 Regulatory Requirements.

### 1.7 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site.

Health and Safety Plan must address project specifications.

- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

#### 1.8 RESPONSIBILITY

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

#### 1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Regulations.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

#### 1.10 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province Territory having jurisdiction and advise Departmental Representative verbally and in writing.

#### 1.11 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have site-related working experience.

- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .5 Be on site during execution of Work and report directly to and be under direction of Registered Occupational Hygienist Certified Industrial Hygienist and or site supervisor.

1.12 POSTING OF  
DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province Territory having jurisdiction, and in consultation with Departmental Representative.

1.13 CORRECTION OF  
NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

## PART 2 - PRODUCTS

<u>2.1 NOT USED</u>	.1	Not used.
---------------------	----	-----------

## PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not used.
---------------------	----	-----------

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Definitions:
  - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
  - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .2 Reference Standards:
  - .1 U.S. Environmental Protection Agency (EPA)/Office of Water
    - .1 EPA 832/R-92-00592, Storm Water Management for Construction Activities, Chapter 3.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures .
- .2 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for review and approval by Departmental Representative.
- .3 Ensure Environmental Protection Plan includes comprehensive overview of known or potential environmental issues to be addressed during construction.

- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Include in Environmental Protection Plan:
  - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
  - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
  - .3 Names and qualifications of persons responsible for training site personnel.
  - .4 Descriptions of environmental protection personnel training program.
  - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations, EPA 832/R-92-005, Chapter 3 requirements.
  - .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
  - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Ensure plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
  - .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Ensure plan includes measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
  - .9 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
  - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
  - .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
  - .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and

detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.15 Pesticide treatment plan to be included and updated, as required.

### 1.3 FIRES

- .1 Fires and burning of rubbish on site permitted when approved by Departmental Representative Engineer Consultant not permitted.

### 1.4 DRAINAGE

- .1 Provide Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Ensure plan includes monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations, EPA 832/R-92-005, Chapter 3 requirements .
- .2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE CLEARING  
AND PLANT  
PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Departmental Representative.

1.6 WORK ADJACENT  
TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Do not use waterway beds for borrow material without Departmental Representative's Engineer's Consultant's approval.
- .3 Waterways to be free of excavated fill, waste material and debris.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

1.7 POLLUTION  
CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials



from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures where indicated directed by Departmental Representative Engineer Consultant .

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

.5 Follow industry best practices for control of pollution associated with concrete work.

.1 The EPP is to include provisions to control potential environmental issues associated with concrete construction with the Park. The provisions should include the following:

.1 Concrete mixer truck washout must be contained in an approved facility with wash products moved back to the concrete batching yard for disposal

.2 Rolling concrete mixers with surplus concrete are to be returned to the batching yard.

.3 Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.

.4 The concrete batching plant must be operated pursuant to applicable dust, air emission, and water quality control regulations.

## 1.8 CONCRETE

### MANAGEMENT

### 1.8 HISTORICAL/ ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known

or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

#### 1.9 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
  - .1 Do not take action until after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

#### PART 2 - PRODUCTS

##### 2.1 NOT USED

- .1 Not Used.

#### PART 3 - EXECUTION

##### 3.1 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

- .2 Burying rubbish and waste materials on site is not permitted.
- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

## PART 1 - GENERAL

### 1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

### 1.2 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

### 1.3 NATIONAL PARKS ACT

- .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

### 1.4 SAFETY

- .1 Observe and enforce all construction safety measures required by applicable codes, regulations and statutes.
- .2 Appoint a suitably qualified employee who has sole responsibility on site, on behalf of the Contractor, for compliance with the requirements noted in 1.1 above.
- .3 In the event of discrepancy between such requirements, the most stringent requirement shall apply.
- .4 Employ a qualified specialist for the design of all

shoring and false work.

- .5 Make available four (4) "Visitor safety helmets" for authorized visitors.
- .6 If "NO SMOKING" regulations are in effect in areas of the Work, ensure that all workers comply with the regulations.
- .7 Ensure that all workers comply with the Owner's safety regulations where such regulations are in effect.
- .8 Do not load or permit to be loaded any part of the Work with a weight, load or force that will exceed the design load and/or endanger its safety.

1.4 WORKING  
LIMITS/EASEMENTS

- .1 Confine all operations within the Owner's property lines unless arrangements have been made by the Owner for easement access to private property.
- .2 Arrange for encroachment on areas beyond property lines or easement boundaries separately with the property owners.
- .3 The Contractor shall ensure that all excavated materials, materials to be incorporated in the Work and employee access shall be maintained within the prescribed limits. Cost of repairs to adjacent property shall be borne by the Contractor.
- .4 The Contractor shall be responsible for negotiating and obtaining permission, in writing, for the use of any other private lands.
- .5 Prior to the Owner formally accepting any construction in easements, the Contractor must have the property owners sign individual easement releases on a form provided by the Owner attesting to the satisfactory restoration of their property.
- .6 In general, restoration within easements will be to a condition equal to that prior to construction. Only trees which are designed for permanent removal shall be removed and not replaced. Existing turf shall be replaced with new turf. Seeding only of existing turfed areas will not be permitted.
- .7 No additional compensation will be allowed the Contractor for restoration in easements and for securing the specified releases from the property owners.
- .8 Work in all backyard and sideyard easements will be carried out in such a manner as to provide the minimum of disruption to the private owner's property. This may require hand digging or combined machine/hand digging in certain minimum clearance areas.
- .9 Timing is of the essence for all Work carried out in the easements. The Contractor shall ensure the Work is carried out in such a manner as to ensure a minimum amount of time is spent within each easement.
- .10 The Contractor shall give the owner of the property where the Work is to be carried out a minimum of 48

hours advance notice of the commencement of the Work and the owner will indicate to the Contractor any limitation regarding access.

- .11 The Contractor shall be fully responsible and pay for all damages which may be the result of his performance of the Work.
- .12 Underground sprinkler system piping, wiring, heads and other associated appurtenances shall be repaired and restored to condition equal to or better than that existing prior to construction.
- .13 Existing fences shall be taken down, where required, and replaced by the Contractor immediately after completion of the Work.
- .14 Where trees, shrubs, bushes are adjacent to the excavation, care will be taken to avoid damage wherever possible.
- .15 The Contractor shall be responsible for removing and replacing any walls, existing buildings or structures located within easements. Replacement of building support pads, foundations, retaining wall or other structures requiring removal for construction purposes will be by the Contractor and such removal and replacement shall be considered as lot restoration for which no additional compensation will be paid.
- .16 The signed release form from the property owner shall not relieve the Contractor from any Warranty obligations under Article 12.3 of the General Conditions.

1.5 EXISTING  
UTILITIES

- .1 The Contractor is responsible to locate all utilities that may be affected by the work or is located within the work area. Cost to locate and protect the utilities will be the responsibility of the Contractor.
- .1 Conform to Provincial and municipal regulations during construction in proximity to utility structures.
- .2 The Contractor shall notify the authority having jurisdiction over each utility one week in advance of the Contractor's anticipated plan to carry out Work in the vicinity of that utility. The Contractor shall also arrange, if required, for a representative of the utility company to be present at the time the Work is being carried out, at no cost to the Owner.
- .3 Make arrangements with utility companies for protection of pipelines, conduits, drain lines, wiring, and other structures, whether underground, on the surface, or overhead, and satisfy each utility company that the methods or operations are effective.
- .4 Indemnify and save harmless the owners of these existing utilities from any loss or damage which may be suffered by reason of the operations of the Contractor in the performance of the Contract.
- .5 At no time operate or adjust in any way an existing utility without first receiving approval from the subject utility.

PART 2 - PRODUCTS

2.4 NOT USED

- .1 Not Used.

PART 3 - EXECUTION



3.5 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT  
INSPECTION AGENCIES

- .1 Other than the Regular Inspection/Testing which are arranged for and paid for by the Contractor, Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.

- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

#### 1.3 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

#### 1.4 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

#### 1.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such

removals or replacements promptly.

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

#### 1.6 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested .

#### 1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

#### 1.8 MILL TESTS

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

#### 1.9 EQUIPMENT AND SYSTEMS

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

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

## Part 1 - General

### 1.1 General

- .1 The Contract Documents contain references to standard specifications for testing, materials, manufacturing and installation procedures. These references have been abbreviated to indentify only the referenced Association and the specification designation. This section provides the full descriptive title of each referenced specification.
- .2 When references to capitalized abbreviations are made, they refer to specifications, standards, or methods of the respective Association. Abbreviations listed herein but not mentioned in the specifications shall be disregarded.
- .3 The numbers and letters following the abbreviations denote the Association's serial designation for the specification or standard to which reference is made.
- .4 All references to these specifications, standards, or methods shall be understood to refer to the latest adopted revision, including all amendments.
- .5 The specifications and standards published by these organizations and other specified specifications and standards referred to in the Contract Documents are hereby made part of these specifications as far as they are applicable to and not inconsistent with these specifications.

### 1.2 Nomenclature

- .1 ACI American Concrete Institute
- .2 ANSI American National Standards Institute
- .3 ASTM American Society of Testing and Materials
- .4 AWWA American Water Works Association
- .5 CAN Prefix signifying endorsement of other current standard as a Canadian National Standard
- .6 CGSB Canadian General Standards Board
- .7 CSA Canadian Standards Association

- .8 CAN3 CAN/CSA
- .9 ATT Alberta Transportation and Utilities Test

### 1.3 Referenced Specifications

- .1 ACI
  - i. ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure .
- . 2 ANSI
  - i. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
  - ii. ANSI B16.5. Pipe Flanges and Flanged Fittings .
- . 3 ANSI/ACI
  - i. ANSI/ACI 117. Tolerances for Concrete Construction and Materials.
  - ii. ANSI/ACI 315. Details and Detailing of Concrete Reinforcement.
- .4 ANSI/AWWA
  - i. ANSI/AWWA C151. Ductile-Iron Pipe. Centrifugally Cast for Water
  - ii. ANSI/AWWA C219. Bolted. Sleeve-Type Couplings for Plain-end Pipe
  - iii. ANSI/AWWA C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
  - iv. ANSI/AWWA B300, Hypochlorites.
  - v. ANSI/AWWA C300, Reinforced Concrete Pressure Pipe - Steel-cylinder Type
  - vi. ANSI/AWWA B301. Water Treatment - Liquid Chlorine.
  - vii. ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron

- Pipe  
and Fittings for Water.
- viii. ANSI/AWWA C105/A21.5, Polyethylene encasement for Ductile-Iron Piping for Water and Other Liquids.
- ix. ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inches through 48 inches for Water and Other Liquids.
- x. ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.
- xi. ANSI/AWWA C150 Thickness Design of Ductile - Iron Pipe.
- xii. ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds for Water or other Liquids.
- xiii. ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings, 3 inches through 16 inches, for Water and Other Liquids.
- xiv. ANSI/AWWA C200. Water Pipe 6 inches and Larger, Steel.
- xv. ANSI/AWWA C203, Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
- xvi. ANSI/AWWA C205, Cement Mortar Protective Lining and Coating for Steel Water Pipe - 4 inches and larger - Shop Applied.
- xvii. ANSI/AWWA C206. Field Welding of Steel Water Pipe.
- xviii. ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Service, 4 inches through 144 inches.
- xix. ANSI/AWWA C208. Fabricated Steel Water Pipe Fittings, Dimensions for.
- xx. ANSI/AWWA C210, Liquid Epoxy



- Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- xxi. ANSI/AWWA C301, Prestressed Concrete Pressure Pipe Steel Cylinder Type for Water and Other Liquids.
- xxii. ANSI/AWWA C303, Reinforced Concrete Pressure Pipe Steel Cylinder Type, Pretensioned for Water and Other Liquids.
- xxiii. ANSI/AWWA C500, Gate Valves for Water and Sewage Systems.
- xxiv. ANSI/AWWA C502, Dry-Barrel Fire Hydrants.
- xxv. ANSI/AWWA C504, Butterfly Valves.
- xxvi. ANSI/AWWA C508, Swing-Check Valves Waterworks Service, 2 in. (50mm). Through 24 in. (600mm) NPS
- xxvii. ANSI/AWWA C509, Resilient-Seated Gate Valves for Water and Sewerage Systems.
- xxviii. ANSI/AWWA C510, Double Check Valve Backflow-Prevention Assembly
- xxix. ANSI/AWWA C511, Reduced-Pressure Principle Backflow-Prevention Assembly
- xxx. ANSI/AWWA C512, Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- xxxi. ANSI/AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants
- xxxii. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains, and their Appurtenances.
- xxxiii. ANSI/AWWA C602, Cement Mortar Lining of Water Pipelines - 100 mm and larger - In Place.
- xxxiv. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC)

- Pressure Pipe and Fittings for Water
- xxxv. ANSI/AWWA C651, Disinfecting Watermains.
  - xxxvi. ANSI/AWWA C800. Underground Service Line Valves and Fittings.
  - xxxvii. ANSI/AWWA C900, Pressure Pipe, 4 inches through 12 inches for Water, Polyvinyl Chloride (PVC).
  - xxxviii. ANSI/AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 2 inch through 3 inches for Water Service.
  - xxxix. ANSI/AWWA C902, Polybutylene (PB) Pressure Pipe and Tubing, 1/2 inch through 3 inches for Water Service.
  - xl. ANSI/AWWA C905, Pressure Pipe, 14 inches through 36 inches for Water, Polyvinyl Chloride (PVC).
  - xli. ANSI/AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 inches through 63 inches, for Water Distribution.
  - xlii. ANSI/AWWA C907, Standard for Polyvinyl Chloride (PVC) Pressure Fittings for Water - 4 inches through 8 inches (100mm through 200mm)
  - xliii. ANSI/AWWA M17, Installation, Field Testing, and Maintenance for Fire Hydrants
  - xliv. ANSI/AWWA M23, PVC Pipe - Design and Installation
  - xlv. ANSI/AWWA M41, Ductile-Iron Pipe and Fittings
- .5 ASTM (A)
- i. ASTM A36. Standard Specification for Structural Steel.
  - ii. ASTM A48. Specification for Gray Iron Castings.
  - iii. ASTM A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless. ASTM A90, Test Method for Weight of

Coating on Zinc-Coated  
(Galvanized) Iron or Steel  
Articles.

- iv. ASTM A120, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
  - v. ASTM A121, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
  - vi. ASTM A283/A283M, Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
  - vii. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  - viii. ASTM A325, Standard Specification for High-Strength Bolts for Structural Steel Joints.
  - ix. ASTM A354, Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners
  - x. A536, Ductile Iron Castings
  - xi. ASTM A585. Specification for Aluminum-Coated Steel Barbed Wire.
  - xii. ASTM563, Carbon and Alloy Steel Nuts
  - xiii. ASTM A615M, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - xiv. ASTM A716. Specification for Ductile - Iron Culvert Pipe.
  - xv. ASTM A746. Specification for Ductile - Iron Gravity Sewer Pipe.
  - xvi. ASTM A760, Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
  - xvii. ASTM A7751 A775M, Specification for Epoxy-Coated Reinforcing Steel Bars .
- . 6 ASTM (B)
- i. ASTM B62, Specification for Composition Bronze or Ounce Metal

Castings.

- ii. ASTM B88M. Specification for Seamless Copper Water Tube.
  - iii. ASTM B633. Electrodeposited Coatings of Zinc on Iron and Steel
  - iv. ASTM B766. Electrodeposited Coatings of Cadmium
- .7 ASTM (C)
- i. ASTM C14M, Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
  - ii. ASTM C76M, Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - iii. ASTM C88, Test Method for Soundness of Aggregates by Use of Sodium Sulphate of Magnesium Sulphate.
  - iv. ASTM C109, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inches of 50 mm Cube Specimens).
  - v. ASTM C117, Test Method for Material Finer than 0.075mm Sieve in Mineral Aggregates by Washing.
  - vi. ASTM C123. Test Method for Lightweight Pieces in Aggregate.
  - vii. ASTM C127, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
  - viii. ASTM C128, Test Method for Specific Gravity and Absorption of Fine Aggregate.
  - ix. ASTM C131, Test Method for Resistance to Degradation of Small Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - x. ASTM C136. Method for Sieve Analysis of Fine and Coarse Aggregates.
  - xi. ASTM C139, Specification for Concrete Masonry Units for Construction of Catchbasins and Manholes.

- xii. ASTM C171, Specification for Sheet Materials for Curing Concrete.
- xiii. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- xiv. ASTM C332, Specification for Lightweight Aggregates for Insulating Concrete.
- xv. ASTM C443M, Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- xvi. ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections.

- xvii. ASTM C497 Test Methods for Concrete Pipe, Manhole Sections, or Tile
- xviii. ASTM C506M Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
- xix. ASTM C507M Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
- xx. ASTM C827 Test Method for Early Volume Change of Cementitious Mixtures.
- xxi. ASTM C902 Specification for Pedestrian and Light Traffic Paving Brick.
- xxii. ASTM C939 Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
- xxiii. ASTM C1433 Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
- xxiv. ASTM C1103 Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines .
- . 8 ASTM (D)
  - i. ASTM D36 Test Method for Softening Point of Bitumen (Ring and Ball Apparatus)
  - ii. ASTM D140 Method for Sampling Bituminous Materials
  - iii. ASTM D412 Test Method for Rubber Properties in Tension.
  - iv. ASTM D570 Test Method for Water Absorption of Plastics
  - v. ASTM D624-86 Test Method for Rubber Property - Tear Resistance.
  - vi. ASTM D698 Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 2.49 kg Rammer and 304.8mm Drop.
  - vii. ASTM D995 Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

- viii. ASTM *D1190* Concrete Joint Sealer, Hot-Applied Elastic Type
- ix. ASTM *D1248* Specification for Polyethylene Plastics Molding and Extrusion Materials.
- x. ASTM *D1557* Specification for Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10 lb (4.54 kg) Rammer and 18 inch (457mm) Drop.

- xi. ASTM D1559, Test Method Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- xii. ASTM D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- xiii. ASTM D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- xiv. ASTM D1784, Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.
- xv. ASTM D2000, Classification System for Rubber Products in Automotive Applications
- xvi. ASTM D2152, Test Method for Quality of Extruded Polyvinyl Chloride (PVC) Pipe by Acetone Immersion.
- xvii. ASTM D2241, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- xviii. ASTM D2310, Classification for Machine Made Reinforced Thermosetting Resin Pipe.
- xix. ASTM D2412, Standard Test Method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading.
- xx. ASTM D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- xxi. ASTM D2657, Heat Fusion Joining of Polyolefin Pipe and Fittings
- xxii. ASTM D2680, Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping
- xxiii. ASTM D2774, Practices for Heat Joining Polyethylene Pipe and Fittings.
- xxiv. ASTM D2774, Practices for



Underground, Installation of  
Thermoplastic  
Pressure Piping.

- xxv. ASTM D2837, Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
- xxvi. ASTM D2992, Method for Obtaining Hydrostatic Design Basis for Reinforced Thermosetting Resin Pipe and Fittings.
- xxvii. ASTM D2996, Specification for Filament Wound Reinforced Thermosetting Resin Pipe.
- xxviii. ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- xxix. ASTM D3139, Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- xxx. ASTM D3203, Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- xxxi. ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seal
- xxxii. ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- xxxiii. ASTM D3405, Specification for Joint Sealants, Hot Poured for Concrete and Asphalt Pavements.
- xxxiv. ASTM 4101. Polypropylene Plastic Injection and Extrusion Materials
- xxxv. ASTM 04318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- xxxvi. ASTM 04354. Practice for Sampling of Geosynthetics for Testing
- .9 ASTM (E)
  - i. ASTM E11. Specification for Wire Cloth Sieves for Testing Purposes.
  - ii. ASTM E 1155M, Test Method for Determining Floor Flatness and

Levelness Using the F-Number  
System .

. 10 ASTM (F)

- i. ASTM F436, Hardened Steel Washers
- ii. ASTM F477, Specification for Elastomeric Seals (Gaskets) for joining Plastic Pipe.
- iii. ASTM F593. Stainless Steel Bolt, Hex Cap Screws, and Studs
- iv. ASTM F594, Stainless Steel Nuts
- v. ASTM F679, Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
- vi. ASTM F714, Polyethylene (PE) Plastic Pipe (SDR-DR) Based on Outside Diameter.
- vii. ASTM F738. Stainless Steel Metric Bolts, Screws, and Studs
- viii. ASTM F794, Specification for Polyvinyl Chloride (PVC) Ribbed Gravity Sewer Pipe and Fittings based on Controlled Inside Diameter.
- ix. ASTM F836M. Style 1 Stainless Steel Metric Nuts

.11 AWWA: (See ANSAI/AWWA)

.12 CAN3 = CAN/CSA:

- i. CAN3-A165 Series. CSA Standards on Concrete Masonry Units.
- ii. CAN3-B137.3, Rigid Poly (Vinyl Chloride) (PVC) Pipe for Pressure Applications.
- iii. CAN4-S543. Internal Lug, Quick-Connect Couplings for Fire Hose.
- iv. CAN3-B70. Cast Iron Soil Pipe and Fittings, and Means of Joining.
- v. CAN3-G401. Corrugated Steel Pipe Products.
- vi. CAN3-A23.3. Design of Concrete Structures for Buildings .

. 13 CAN/CSA = CAN3:

- i. CAN/CSA-A5, Portland Cement.
- ii. CAN/CSA-A8, Masonry Cement.
- iii. CAN/CSA-A23.1, Concrete Materials and Methods for Concrete Construction.
- iv. CAN/CSA-A23.2, Methods of Testing for Concrete.
- v. CAN/CSA-A23.5, Supplementary Cementing Materials.
- vi. CAN/CSA-A231.2, Precast Concrete Pavers.
- vii. CAN/CSA-A266.1, Air-Entraining Admixtures for Concrete.
- viii. CAN/CSA-A266.2, Chemical Admixtures for Concrete.
- ix. CAN/CSA-A266.4, Guidelines for the use of Admixtures in Concrete.
- x. CAN/CSA-A362, Blending Hydraulic Cement.
- xi. CAN/CSA-A363, Cementitious Hydraulic Slag.
- xii. CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
- xiii. CAN/CSA B182.6-M, Profile Polyolefin Sewer Pipe & Fittings
- xiv. CAN/CSA-G40.21, Structural Quality Steels .

. 14 CAN/CGSB

- i. CAN/CGSB-8.1, Sieves Testing, Woven Wire.
- ii. CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.
- iii. CAN/CGSB-138.1, Fence, Chain Link, Fabric.
- iv. CAN/CGSB-138.2, Fence, Chain Link, Framework, Zinc-Coated, Steel.

- v. CAN/CGSB-138.3, Fence Chain Link - Installation.
- vi. CAN/CGSB-138.4, Fence, Chain Link, Gates.
- vii. CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- viii. CAN/CGSB-16.1, Asphalts, Liquids Petroleum, for Road Purposes.
- ix. CAN/CGSB-16.2, Asphalts, Emulsified, Anionic Type, for Road Purposes.
- x. CAN/CGSB-16.3, Asphalt Cements for Road Purposes.
- xi. CAN/CGSB-16.S, Asphalt, Emulsified, High Float Type, for Road Purposes.

.15 CGSB

- i. CGSB 1-GP-12c, Standard Paint Colours.
- ii. CGSB 1-GP-S9M, Enamel, Exterior Gloss Alkyd Type.
- iii. CGSB 1-GP-SM, Thinner, Petroleum Spirits, Low Flash (CR/84).
- iv. CGSB 1-GP-71, Method of Testing Paints and Pigments.
- v. CGSB 1-GP-74M, Paint, Traffic, Alkyd.
- vi. CGSB 1-GP-149M, Paint, Traffic, Reflectorized Alkyd, White and Yellow.
- vii. CGSB 15.1 Calcium Chloride
- viii. CGSB 1-GP-181M, Coating, Zinc-Rich, Organic, Ready Mixed.
- ix. CGSB 51-GP-51M, Polyethylene Sheet for Using in Building Construction.
- x. CGSB 41-GP-25M, Pipe, Polyethylene, for the Transport of Liquids.

.16 CSA

- i. CSA A82.5. Structural Clay Non-Load-Bearing Tile.
- ii. CSA A82.56, Aggregate for Masonry Mortar.
- iii. CSA A123.3, Asphalt or Tar Roofing Sheets.
- iv. CSA A257, Standards for Concrete Pipe.
- v. CSA B137.0. Definitions, General Requirements, and Methods of Testing for Thermoplastic Pressure Piping.
- vi. CSA B137.1. Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.
- vii. CSA B137.2. PVC Injection Moulded Gasketed Fittings for Pressure Applications.
- viii. CSA B137.3. Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- ix. CSA B137.6. CPVC Pipe, Tubing and Fittings for Hot and Cold Water Distribution Systems.
- x. CSA B137.7. Polybutylene (PB) Pipe for Cold Water Distribution Systems.
- xi. CSA B137.8. Polybutylene (PB) Pipe for Pressure Applications.
- xii. CSA B137.9. M91. Polyethylene / Aluminum / Polyethylene Composite Pressure Pipe.
- xiii. CSA B137.16. Recommended Practice for the Installation of CPVC Piping for Hot and Cold Water Distribution Systems.
- xiv. CSA B181.12. Recommended Practice for the Installation of PVC Drain, Waste, and Vent Pipe Fittings.
- xv. CSA B182.1. Plastic Drain and Sewer Pipe and Pipe Fittings.
- xvi. CSA B182.11. Recommended Practice for the Installation of Plastic Drain and Sewer Pipe and Pipe Fittings.
- xvii. CSA B182.2. Large Diameter, Type PSM PVC Sewer Pipe and Fittings.
- xviii. CSA B182.4, Large Diameter Ribbed

PVC Sewer Pipe and Fittings.

- xix. CSA C22.1. Safety Standard for Electrical Installations.
- xx. CSA C22.2. Canadian Electrical Code, General Requirements.
- xxi. CSA C22.3. Canadian Electrical Code Outside Wiring.
- xxii. CSA G30.3. Cold Drawn Steel Wire for Concrete Reinforcement.
- xxiii. CSA G30.5. Welded Steel Wire Fabric for Concrete Reinforcement.
- xxiv. CSA 30.12. Billet-Steel Bars for Concrete Reinforcement.
- xxv. CSA G30.14. Deformed Steel Wire for Concrete Reinforcement.
- xxvi. CSA G30.15, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- xxvii. CSA G30.16, Weldable Low Allow Steel Deformed Bars for Concrete Reinforcement.
- xxviii. CSA G164. Hot Dip Galvanizing of Irregularly Shaped Articles.
- xxix. CSA S157, Strength Design in Aluminum.
- xxx. CSA S269.3, Formwork.
- xxxi. CSA W59. Welded Steel Construction (Metal Arch Welding).
- xxxii. CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction
- xxxiii. CSA G40.20, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels

.17 ATT

i) ATT-50, Percent Fracture

#### 1.4 Product Conformance

- i. If there is question as to whether any product or system is in conformance with applicable standards, the *Departmental Representative* reserves the right to have such products or systems tested

to prove or disprove conformance.  
The cost for such testing will be borne by the  
*Departmental Representative* in the event of conformance with *Contract Documents* or by the *Contractor* in the event of non-conformance.





PART 1 - GENERAL

1.1 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

- .1 The contractor will provide continuous supply of potable water for construction use.
- .2 The Contractor will arrange for connection and will pay for costs for installation, maintenance and removal.

1.6 TEMPORARY  
HEATING AND  
VENTILATION

---

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside a building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and products against dampness and cold.
  - .3 Prevent moisture condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, not to be used when available.
- .7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.

- .8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.8 TEMPORARY POWER  
AND LIGHT

- .1 Contractor to provide temporary power required to perform the Work.
- .2 The Contractor will arrange for connection with appropriate utility and pay costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.9 TEMPORARY  
COMMUNICATION  
FACILITIES

- .1 Provide and pay for temporary telephone, fax, data hook up, lines, equipment necessary for own use.

1.10 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY  
EROSION AND  
SEDIMENTATION  
CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.189, Exterior Alkyd Primer for Wood.
  - .2 CGSB 1.59, Alkyd Exterior Gloss Enamel.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-0121-08, Douglas Fir Plywood.
  - .3 CAN/CSA-S269.2, Access Scaffolding for Construction Purposes.
  - .4 CAN/CSA-Z321, Signs and Symbols for the Occupational Environment.
- .4 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### 1.2 SUBMITTALS

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

### 1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to

prevent tracking of mud.

- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

#### 1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps ladders, swing staging, platforms, and temporary stairs and.

#### 1.5 HOISTING

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists and cranes to be operated by qualified operator.

#### 1.6 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.
- .3 Coordinate area and location with Departmental Representative.

#### 1.7 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work in the designated parking area as assigned by the Departmental

Representative.

- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

#### 1.8 SECURITY

- .1 It is the responsibility of the contractor to secure their equipment and construction materials.

#### 1.9 OFFICES

- .1 Departmental Representative will provide an office for bi-weekly project meeting only. Location to be determined by the Departmental Representative.
- .2 Contractor will arrange for their own office space for project administration and daily operation.

#### 1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

#### 1.11 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.12 CONSTRUCTION  
SIGNAGE

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Departmental Representative Engineer Consultant.
- .2 Construction sign 2.44 x 2.44 m, of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.
- .3 Indicate on sign, name of Owner, and Contractor and Subcontractor, of design style established by Departmental Representative Engineer Consultant as detailed.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.
- .5 Signage wording must be in both official languages.
- .6 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .7 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative Engineer Consultant.

1.13 PROTECTION AND  
MAINTENANCE OF  
TRAFFIC AND PARKING

- .1 Provide access and temporary relocated roads as necessary to maintain traffic and parking areas for site.
- .2 Maintain and protect traffic on affected roads and parking areas during construction period except as otherwise specifically directed by Departmental Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .4 Protect travelling public from damage to person and property.



- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public, pedestrian, and park operations traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .8 Dust control: adequate to ensure safe operation at all times.
- .9 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative Engineer Consultant.
- .10 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .11 Provide snow removal during period of Work.
- .12 Remove, upon completion of work, haul roads designated by Departmental Representative Engineer Consultant.

#### 1.14 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

## PART 2 - PRODUCTS

<u>2.15 NOT USED</u>	.1	Not Used.
----------------------	----	-----------

## PART 3 - EXECUTION

<u>3.16 TEMPORARY EROSION AND SEDIMENTATION CONTROL</u>	.1	Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
	.2	Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
	.3	Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-0121-08M1978(R2003), Douglas Fir Plywood.

### 1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

### 1.3 HOARDING

- .1 Erect temporary site enclosures using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one lockable truck gate. Maintain fence in good repair.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

### 1.4 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities as indicated.

#### 1.5 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

#### 1.6 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

#### 1.7 ACCESS TO SITE

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

#### 1.8 PUBLIC TRAFFIC FLOW

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

#### 1.9 FIRE ROUTES

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

1.10 PROTECTION FOR  
OFF-SITE AND PUBLIC  
PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.11 PROTECTION OF  
BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative eer locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.12 WASTE  
MANAGEMENT AND  
DISPOSAL

- .1 Separate waste materials for reuse and recycling and disposal.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not Used.
---------------------	----	-----------

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor Design-Builder in event of non-conformance.

### 1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to

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

- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

### 1.3 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

### 1.4 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or



bundling until required in Work.

- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials and lumber and on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### 1.5 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.

#### 1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative Engineer Consultant in writing, of conflicts between

specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

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

#### 1.7 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

#### 1.8 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

#### 1.9 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.10 REMEDIAL WORK

- .1 Refer to CCDC 2DOC 14 DOC 15 and Section 01 73 00 - Execution Requirements.
- .2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF  
FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.12 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of

material to which anchorage is made are not acceptable.

1.13 FASTENINGS -  
EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF  
WORK IN PROGRESS

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

1.15 EXISTING  
UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

<u>2.16 NOT USED</u>	.1	Not Used.
----------------------	----	-----------

PART 3 - EXECUTION

<u>3.17 NOT USED</u>	.1	Not Used.
----------------------	----	-----------

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
  - .1 Structural integrity of elements of project.
  - .2 Integrity of weather-exposed or moisture-resistant elements.
  - .3 Efficiency, maintenance, or safety of operational elements.
  - .4 Visual qualities of sight-exposed elements.
  - .5 Work of Owner or separate contractor.
- .3 Include in request:
  - .1 Identification of project.
  - .2 Location and description of affected Work.
  - .3 Statement on necessity for cutting or alteration.
  - .4 Description of proposed Work, and products to be used.
  - .5 Alternatives to cutting and patching.
  - .6 Effect on Work of Owner or separate contractor.
  - .7 Written permission of affected separate contractor.
  - .8 Date and time work will be executed.

1.2 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

### 1.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 Confirm all dimensions and measurements shown on the as-built drawings with existing structures in the work site. Commencement of the execution of work means the contractor accepts that the dimensions and measurements shown are accurate and accepts that he is now responsible for any discrepancies between the as-built drawings and what was found in the field.
- .3 The contractor is responsible to establish required survey points to establish lines and grades required to do the work. The contractor will be required to provide the equipment and personnel to ensure the Work is constructed to the depths and grades indicated in the drawings and specifications.
- .4 After uncovering, inspect conditions affecting performance of Work.
- .5 Beginning of cutting or patching means acceptance of existing conditions.
- .6 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .7 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

### 1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work

for penetrations of mechanical and electrical Work.

- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE  
MANAGEMENT AND  
DISPOSAL

- .1 Separate waste materials for reuse, recycling, and disposal.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.



PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not Used.
---------------------	----	-----------

PART 1 - GENERAL

1.1 Commissioning of Process  
Systems

- .1 Prior to Final Completion of the Work, perform the commissioning of all equipment, systems, and controls as per the requirements of Section 40 80 00 – Commissioning of Process Systems to demonstrate the compliance of the equipment and systems to meet the specifications.

1.1 FINAL CLEANING

- .1 Prior to Substantial Performance of the Work, remove surplus Products, tools, construction machinery and equipment not required for the performance of the remaining Work.
- .2 Remove waste Products and debris and leave the Work clean and suitable for occupancy by Owner.
- .3 Prior to Total Performance, remove surplus Products, tools, construction machinery, equipment, waste products and debris.
- .4 Leave the Work clean before the final inspection process commences.
- .5 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures.

- 
- Replace broken, scratched or disfigured glass.
- .6 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors, and ceilings.
  - .7 Vacuum clean and dust building interiors, behind grilles, louvers and screens.
  - .8 Wax, seal, shampoo or prepare building floor finishes, as recommended by the manufacturer.
  - .9 Inspect finishes, fitments, and equipment and ensure specified workmanship and operation.
  - .10 Broom clean and wash exterior walks, steps and surfaces.
  - .11 Remove dirt and other disfigurations from exterior building surfaces.
  - .12 Clean and sweep roofs, gutters, downspouts, areaways, and sunken walls.
  - .13 Sweep and wash clean site paved areas.
  - .14 Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

1.2 SYSTEM  
DEMONSTRATIONS

- .1 Prior to final inspection, demonstrate operation of each system to Owner and Departmental Representative.
- .2 Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using provided operation and maintenance data as the basis for instruction.

1.3 DOCUMENTS

- .1 Collect reviewed submittals and assemble documents completed by Subcontractors, Suppliers, and Manufacturers.
- .2 Submit material prior to application for Substantial Performance of the Work. For equipment put into use with Owner's permission during construction, submit within ten (10) days after start-up.
- .3 Provide warranties fully executed and notarized.
- .4 Execute transition of Performance and Labour and Materials Payment Bond to warranty period requirements.

1.4 REMOVAL OF  
TEMPORARY FACILITIES

- .1 Prior to application for Substantial Performance of the Work remove all temporary offices and furniture, hoardings, fencing, tree and plant protection and all other items used to aid the performance of the Work. Make good surfaces.

1.5 PROJECT  
COMMISSIONING

- .1 Expedite and complete deficiencies and defects identified by the Departmental Representative.
- .2 Review maintenance manual contents (operating, maintenance instructions, record "asbuilt" drawings, spare parts, materials) for completeness.
- .3 Submit required documentation such as statutory declarations, Workers' Compensation certificates, warranties, certificates of approval or acceptance from regulating bodies.
- .4 Attend "end-of-work" testing and break-in or start-up demonstrations.
- .5 Review inspection and testing reports to verify conformance to the intent of the documents and that changes, repairs or replacements have been completed.
- .6 Meet with other Project Departmental Representatives to co-ordinate completion testing approvals.
- .7 Review condition of equipment which has been used in the course of the Work to ensure all equipment is in "as new condition" with warranties dated and certified from date of Substantial Performance of the Work.
- .8 Arrange and co-ordinate instruction of Owner staff in care, maintenance and operation of building systems and finishes by Suppliers or

Subcontractors.

- .9 When partial occupancy of uncompleted Project is required by the Owner, co-ordinate Owner's uses, requirements, access, with Contractor's requirements to complete the Work.
- .10 Co-ordinate Owner's moving-in of staff, furnishings, equipment with building accessibility, traffic, and Contractor's and Subcontractor's cleaning-up and completion activities all to suit Owner's work schedule and to not disrupt Owner's productivity.
- .11 Provide on-going review, inspection and attendance to call-back, maintenance and repair problems during the Warranty Period.

1.6  
INSPECTION/TAKEOVER  
PROCEDURES

PART 2 - PRODUCTS

- .1 During the final inspection, a list of deficiencies will be tabulated. Correct same.

2.2 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.3 NOT USED

- .1 Not Used.

---

## 1 GENERAL

### 1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A 653/A 653M-05a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .2 ASTM C 578-05a, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - .3 ASTM C 1289-05a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - .4 ASTM D 1761-88(2000), Standard Test Methods for Mechanical Fasteners in Wood.
  - .5 ASTM D 5055-05, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
  - .6 ASTM D 5456-05a, Standard Specification for Evaluation of Structural Composite Lumber Products.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-11.3-M87, Hardboard.
  - .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .4 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA O112 Series-M1977(R2006), CSA Standards for Wood Adhesives.
  - .4 CSA O121-2008, Douglas Fir Plywood.
  - .5 CSA O122-06, Structural Glued-Laminated Timber.
  - .6 CSA O141-05, Softwood Lumber.
  - .7 CSA O151-09, Canadian Softwood Plywood.
  - .8 CSA O153-M1980(R2008), Poplar Plywood.

- - .9 CAN/CSA-0325-07, Construction Sheathing.
  - .10 CSA 0437 Series-93(R2006), Standards on OSB and Waferboard.
- .4 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2003 (Edition 2007).
  - .2 Canadian Lumber Grading Manual (2010).
- .5 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1113-07, Architectural Coatings.
  - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .6 Truss Design and Procedures for Light Metal Connected Wood Trusses, Truss Plate Institute of Canada.
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S706-2009, Mineral Fibre Thermal Insulation for Buildings.
- 1.02 ACTION AND INFORMATIONAL SUBMITTALS
  - .1 Submit Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures.
- 1.03 QUALITY ASSURANCE
  - .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
  - .2 Plywood and wood based composite panels in accordance with CSA and ANSI standards.
- 1.04 DELIVERY, STORAGE, AND HANDLING
  - .1 Waste Management and Disposal:
  - .2 Separate waste materials for reuse, recycling and disposal.

## **2 PRODUCTS**

### **2.01 FRAMING AND STRUCTURAL MATERIALS**

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA 0141.



- 
- .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .2 Low - Emitting Materials: Composite Wood and Laminates Adhesives.
    - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.
  - .3 Glued end-jointed (finger-jointed) lumber NLGA Special Products Standard.
  - .4 Trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", Truss Plate Institute of Canada.
  - .5 Framing and board lumber: in accordance with NBC:
    - .1 SPF species, #2 grade Minimum.
  - .6 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
    - .1 Board sizes: "Standard" or better grade.
    - .2 Dimension sizes: "Standard" light framing or better grade.
    - .3 Post and timbers sizes: "Standard" or better grade.
  - 2.02 PANEL MATERIALS
    - .1 Low - Emitting Materials: Composite Wood and Laminates Adhesives.
      - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.
    - .2 Douglas fir plywood (DFP): to CSA 0121, standard construction.
  - 2.03 ACCESSORIES
    - .1 Exterior wall sheathing paper: to CAN/CGSB-51.32 single ply.
    - .2 General purpose adhesive: to CSA 0112 Series.
      - .1 Maximum allowable VOC limit 140 g/L.
    - .3 Nails, spikes and staples: to CSA B111.
    - .4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
    - .5 Proprietary fasteners: toggle bolts, expansion shields

- 
- and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
  - .6 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
  - .7 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, formed to prevent dishing. Bell or cup shapes not acceptable.
  - .8 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy, type approved by Departmental Representative.

#### 2.04 FASTENER FINISHES

- .1 Galvanizing: to CAN/CSA-G164, ASTM A 653, use galvanized fasteners for exterior work, interior, pressure-preservative treated lumber.

#### 2.05 WOOD PRESERVATIVE

- .1 SCAQMD Rule #1113 - Architectural Coatings.
- .2 Maximum allowable VOC limit 350 g/L.
- .3 Parks Canada: Guide for the Use, Handling and Disposal of Pressure Treated Wood.

### 3 EXECUTION

#### 3.01 PREPARATION

- .1 Store wood products.

#### 3.02 INSTALLATION

- .1 Comply with requirements of latest NBC Part 9 supplemented by following paragraphs.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.

- 
- 
- 
- .5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
  - .6 Install wall sheathing in accordance with manufacturer's printed instructions.
  - .7 Install roof sheathing in accordance with requirements of NBC.
  - .8 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding, electrical equipment mounting boards, and other work as required.
  - .9 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
    - .1 Align and plumb faces of furring and blocking to tolerance of 1:180.
  - .10 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
  - .11 Install fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
  - .12 Install sleepers as indicated.
  - .13 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- 3.03 ERECTION
- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
  - .2 Countersink bolts where necessary to provide clearance for other work.
  - .3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.
- 3.04 SCHEDULES
- .1 Roof sheathing:
    - .1 Plywood, standard sheathing grade, square edge,

— 16 mm thick.

- .2 Exterior wall sheathing:
  - .1 Plywood, exterior grade, square edge, 16 mm thick.
- .3 Electrical equipment mounting boards:
  - .1 Plywood, square edge 19 mm thick.

**END OF SECTION**

## **1 GENERAL**

### **1.01 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Master Painters Institute (MPI)
  - .1 MPI Architectural Painting Specifications Manual.
  - .2 MPI - Maintenance Repainting Manual.

### **1.02 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit product data and instructions for each paint and coating product to be used.
  - .2 Submit product data for the use and application of paint thinner.
  - .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.
  - .4 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .5 Submit manufacturer's installation and application instructions.

### **1.03 STORAGE AND HANDLING**

- .1 Storage and Protection:
  - .1 Provide and maintain dry, temperature controlled, secure storage.
  - .2 Store materials and supplies away from heat generating devices.
  - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .2 Fire Safety Requirements:
  - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
  - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

### **1.04 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse, recycling and disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

- .4 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

#### 1.05 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
  - .1 Ventilate enclosed spaces in accordance with manufacturer's recommendations.
  - .2 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
  - .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
  - .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Additional application requirements:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

## **2 PRODUCTS**

#### 2.01 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Conform to latest MPI requirements for all painting work including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual "Approved Product" listing.

- .6 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.
- .7 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

**2.02** COLOURS

- .1 Submit proposed Colour Schedule to Departmental Representative for review.
- .2 Colour to match that which is on existing VOC building.

**2.03** MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written instructions. Obtain written approval from Departmental Representative for tinting of painting materials.
- .2 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .3 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

**2.04** EXTERIOR PAINTING

- .1 Exterior surfaces of Water Utility Building to be painted/stained using a similar product/colour as on the existing VOC.

**3 EXECUTION**

**3.01** GENERAL

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.

**3.02** EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

- .2 Conduct moisture testing of surfaces to be painted using properly testing equipment. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

### 3.03 PREPARATION

- .1 Protection:
  - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
  - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
- .2 Surface Preparation:
  - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
  - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
  - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.
- .3 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
- .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
  - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
  - .2 Apply wood filler to nail holes and cracks.
  - .3 Tint filler to match stains for stained woodwork.
- .6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
- .8 Touch up of shop primers with primer as specified.
- .9 Do not apply paint until prepared surfaces have been accepted by



Departmental Representative.

3.04 APPLICATION

- .1 Method of application to be as approved by Departmental Representative. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .3 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .4 Sand and dust between coats to remove visible defects.
- .5 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

3.05 MECHANICAL/ELECTRIC AL EQUIPMENT

- .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
- .2 Do not paint over nameplates.
- .3 Paint both sides and edges of backboards for telephone and electrical equipment with fire retardant paint before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

END OF SECTION

## **1 GENERAL**

### **1.01 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2.
  - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1-1958.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

### **1.02 DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

### **1.03 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00- Submittal Procedures.
- .2 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
  - .2 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Provide CSA certified products and material..
  - .2 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .3 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

- .4 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system, as described in PART 3 - FIELD QUALITY CONTROL.

#### 1.05 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
  - .1 In accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts.
  - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
    - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
    - .2 Twice during progress of Work at 33% and 66% complete.
    - .3 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse, recycling and disposal.

## **2 PRODUCTS**

#### 2.01 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified.

#### 2.02 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

#### 2.03 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red

up to 250 V Yellow

up to 600 V Yellow Green

up to 5 kV Yellow Blue

up to 15 kV Yellow Red

#### 2.04 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

### **3 EXECUTION**

#### 3.01 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

#### 3.02 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

#### 3.03 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

#### 3.04 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm

horizontal clearance between boxes.

- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

### 3.05 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: 400 mm.
    - .2 Above top of counters or counter splash backs: 200 mm.
    - .3 In storage room: 1200 mm.
  - .3 Panelboards: as required by Code or as indicated.

### 3.06 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### 3.07 FIELD QUALITY CONTROL

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
- .3 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of

Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

---

3.08 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

## PART 1 - GENERAL

### 1.1 QUALITY ASSURANCE/ REGULATORY REQUIREMENTS

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial regulations.

### 1.2 EXISTING CONDITIONS

- .1 Buried services:
  - .1 Before commencing work establish location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 20 mm washed pea gravel is to be used for bedding under the cistern.
- .2 Materials excavated for the cistern installation

can used for backfill as per manufacturer's instructions provided any and all large rock has been removed from the material.

- .3 20 mm crushed gravel is to be used to resurface any road surface that is disturbed by the Work.

### PART 3 - EXECUTION

#### 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

#### 3.2 PREPARATION/ PROTECTION

- .1 Protect excavations from freezing.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .4 Protect buried services that are required to remain undisturbed.



### 3.3 CLEARING AND GRUBBING

- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
- .2 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

### 3.4 EXCAVATION

- .1 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
  - .1 Stockpile topsoil on site for later use.
- .2 Excavate as required to carry out work.
  - .1 Do not disturb soil or rock below bearing surfaces.
  - .2 Notify Departmental Representative when excavations are complete.
  - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
  - .4 Excavate only what is required to install the new cistern and associated piping. Keep overexcavation to minimum.

### 3.5 BACKFILLING

- .1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by Departmental Representative.
- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .1 Fill excavated areas with selected material compacted as specified by the manufacturer of the tanks being installed for fill.

- .5 Ensure proper bedding materials such as sand is placed around any waterlines installed in trenches minimum 300 mm in depth above and below pipe. After bedding material has been placed around pipes utilize existing excavated material to backfill any open excavations.
- .4 Placing:
  - .1 Place backfill, add water as required to achieve specified density.
- .5 Compaction: confirm compaction requirements around the tanks with the manufacturer. Some tanks are installed with the backfill being placed with no compaction to ensure there is no damage to the integrity of the tank during installation. Contactor is to follow the recommendations for compaction of the tank manufacturer.
- .6 Backfill in lifts not greater than 300 mm with granular material around the tanks.
- .7 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .8 Underground tanks: Install as per manufacturers instructions. Place a 150 mm of washed sand or 19mm washed pea gravel as bedding under the tank.
- .9 Reinstate the portions of the parking lot that have been disturbed for the installation of the cistern and piping to connect to the VOC. Ensure proper compaction is achieved in the backfill of the trench for the piping and place a minimum 300 mm lift of 19mm road crush to reestablish the driving and parking surfaces that were disturbed as part of the work. The new road and parking surfaces are to be built level with the connecting road and parking lot areas.

### 3.6 FIELD QUALITY CONTROL

- .1 Do not begin backfilling or filling operations until material to be used for this purpose has been approved for use by Departmental Representative.

Bar U Ranch NHS	EARTHWORK - SHORT FORM	Sect 31 00 00
VOC Cistern		Page 107
BU13-04-013		2013-02-13

### 3.7 SHORTAGE AND SURPLUS

- .1 Supply necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.
- .2 Dispose of surplus material off site.

### 3.8 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

## **1 GENERAL**

### **1.01 REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  - .2 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile Iron and Gray Iron Fittings for Water.
  - .3 ANSI/AWWA C111/A21.11-07, American National Standard for Rubber Gasket-Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .4 ANSI/AWWA C151/A21.51-09, AWWA Standard for Ductile-Iron Pipe, Centrifugally Cast.
  - .5 ANSI/AWWA C901-08, AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½ Inch (13 mm) through 3 Inch (76 mm), for Water Service.
- .1 ASTM International
  - .1 ASTM A 307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Manufacturer's Standardization Society of the Valve and Fittings Industry
  - .1 MSS-SP-70-11, Gray Iron Gate Valves, Flanged and Threaded Ends.

### **1.02 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for [valves, couplings and mechanical joints] and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.04 CLOSEOUT SUBMITTALS**

- .2 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Operation and Maintenance Data: submit operation and maintenance data for for incorporation into manual.

### **1.03 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect piping materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **2 PRODUCTS**

### **2.04 PIPE**

- .1 Service water pipe: polyethylene (PE)
- .4 Polyethylene (PE) pipe: ANSI/AWWA C901.

### **2.05 FITTINGS**

- .1 NPS 3 and larger mechanical joints or flanged: to ANSI/AWWA C110/A21.10.

### **2.06 JOINTS**

- .1 Rubber gaskets for mechanical joints or flanges: to ANSI/AWWA C111/A21.11.
- .2 Bolts, nuts, hex head with washers: to ASTM A 307, heavy series.

### **2.07 GATE VALVES**

- .1 Rising stem: to MSS SP-70, class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

## **3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code local authority having jurisdiction.
- .2 Piping cut square, reamed, free of cuttings and foreign material.
- .3 Minimum depth of bury: 3m.
- .4 Lay buried piping in compacted washed sand in accordance with AWWA

Class "B" bedding.

- .5 Where piping enters building, provide support, and seal against ingress of moisture to approval of authority having jurisdiction.
- .6 Assemble piping using fittings manufactured to ANSI standards and in accordance with manufacturer's instructions.
- .7 Apply [1] layer of protective coating to buried piping as required.

### 3.03 PRESSURE TESTING

- .1 All lines to carry water shall be hydrostatically tested. Follow the procedures as laid out un CSA B137 for the size of pipe used.

### 3.04 DISINFECTION

- .1 Disinfect water lines as per the requirements AWWA C651. Bacteriological testing and reporting to include total coliforms, fecal coliforms, and background colonies on the total coliform plate. The presence of any coliform bacteria or background bacteria over 200 colony forming units shall constitute a failed test

### 3.05 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 11 - Cleaning].
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

## **1 GENERAL**

### **1.01 GENERAL**

- .1. This Section 33 16 16 refers to those portions of the Work that are unique to the supply and installation of the underground potable water cistern as described herein. This Section must be referenced to and interpreted simultaneously with all other Sections pertinent to the Work described herein .
- .2. This Section also includes payment for all Work included in Section 43 21 39 Submersible Well Pump

### **1.02 RELATED WORK**

- .1. Section 43 21 39 Submersible Well Pump

### **1.03 INTENT**

- .1 Provide complete, fully tested and operational underground cistern for potable water storage to meet requirements described herein and in accordance with applicable codes and ordinances.

### **1.04 SUBMITTALS**

- .1. Provide Shop Drawings and Project Record Documents including Equipment and Systems Manuals, Product Data, Materials and Finishes and Operation and Maintenance Data and Section 01 33 00 Submittal Procedures.

## **2 PRODUCTS**

### **2.01 UNDERGROUND CISTERN**

- .1 Provide an underground cistern for potable water storage (NSF 61 approved). Volume of cistern shall be 5000 Imperial gallons
- .2 Provide openings in the tank for the inlet and outlet piping and the vent piping .
- .3 Install submersible well pump and related equipment as per manufacture recommendation. Refer to Specification Section 43 21 39 Submersible Well Pump for details.
- .4 Tank to be a precast concrete tank with an antifoatation pad built to conform to CSA B66 05 Prefabricated Septic Tanks and Sewage Holding Tanks.
- .5 The tank is to lined with a self-adhering waterproofing membrane that is compatible with potable water applications.
- .6 The cistern is to have a riser tube that extends from the top of the cistern to the underside of the slab of the Water Utility Shed to allow for access into the cistern for cleaning and maintenance.

### **3 EXECUTION**

#### **3.01 UNDERGROUND CISTERN**

- .1 Tank to be installed in accordance to manufacturer's instructions
- .2 Excavate to design grade. Tank once installed should have a minimum of 3 m cover.
- .3 Supply, place and compact granular base gravel to the thickness as specified by the manufacturer.
- .4 Shape base true to grade to provide continuous, uniform bearing surface for tank.
- .5 Place tank on granular base in accordance with the manufacturer's instructions. Do not use concrete blocks when setting the tank .
- .6 Backfill and compact around the tank with select Native granular material.
- .7 Supply and install the inlet and outlet pipes. Make each connection at the tank water tight.
- .8 Supply and install the manway extensions, collars, and lid in accordance with manufacturer's instructions .
- .9 Install gooseneck vent, with bird screen.

### **3.2 Testing and COMMISSIONING**

- .1 Testing of cistern in accordance with manufacturer's instructions .
  - .2 Pressure test pipes in accordance with Section 33 11 16 Incoming Site Water Utility Distribution Piping
- END OF SECTION

**END OF SECTION**



## 1 GENERAL

### 1.01 Description

- .1 These specifications apply to all process piping, valves, fittings and appurtenances related to systems conveying treated and untreated water. This includes all piping:
  - .1 Above ground;
  - .2 Inside facilities;
  - .3 Below ground within 2.0 m of facilities;
  - .4 Process air pipe and fittings.
- .2 Provide complete, fully tested and operational process components and materials to meet requirements described herein and in complete accord with applicable codes and ordinances.
- .3 Submittals for Review
  - .1 Before fabrication, provide manufacturer data for each type of pipe material and for each fitting.
  - .2 Before fabrication, provide shop drawings for fabricated fittings.
  - .3 Before delivery to site provide manufacturer data for each valve, coupling, expansion joint, guide and appurtenance used to complete the work covered in this section.
  - .4 Before pipe coating, provide manufacturer's technical data for proposed pipe coatings.
  - .5 Shop Drawings: Shop drawings for all piping systems greater than 50mm O, shall be furnished prior to fabrication. Indicate in orthogonal and/or isometric drawings as required to furnish the assembly details, the welds, flanges, valve placement, expansion joints, guides, vents, drains, instrument connections, supports, anchors, and the provisions for thrust and seismic restraint as well as any other pertinent details.

- .6 Do not commence work on items requiring submittals until Departmental Representative's review is complete and approval to commence with fabrication is provided.
- .7 Welder Qualifications
  - .1. All welders shall be qualified for the particular welding procedure they will perform. Welders shall hold a valid journeyman level C, B or A level ticket. All welders shall possess a valid Welders performance Qualification Record (WPQR) book issued under the authority of the provincial boiler and pressure vessel safety program. Any weld test specimen coupon(s) required by the certified welding inspection company shall clearly identify the welder(s).
  - .2. Provide copy of welders' certification to Departmental Representative prior to starting work.

## **2 PRODUCTS**

### **2.01 Anti-Galvanic Insulation**

- .1 Provide flange isolation kits where stainless steel pipe or fittings connect to a dissimilar metal.
- .2 Anti-galvanic materials such as neoprene, silicon, nylon or other approved non-conducting material shall be used between stainless steel and all other dissimilar metal.

### **2.02 Automatic Air Release Valves**

- .1 Air Valve shall have a 12mm inlet pipe diameter and a 1.5mm (1/16'') outlet orifice.
- .2 Valve assembly shall include an isolation ball valve, 12mm schedule stainless steel connection piping, and 19mm diameter copper pipe connected to

the discharge and plumbed to drain to a below adjacent floor drain. Ensure physical air gap of 150mm between the end of discharge piping and the floor drain.

- .3 Automatic Air Release Valve shall be rated for a minimum working pressure of 1035kPag (150psig).
- .4 Air Release Valve shall have a cast iron body coated with fusion bonded epoxy to all internal and extemal metal surfaces or a stainless steel body. All valve seating shall be resilient for positive shutoff, Valve shall be approved for potable water applications and be NSF/AWWA certified. All seals and seat materials shall be AWWA, NSF61 approved.
- .5 Automatic Air Release Valve shall be manufactured by Val-Matic, Apco or approved equal.

## **2.03 Ball Valves (Manual and Electrically Actuated)**

### **.1 Stainless Steel Ball Valves**

- .1 Valves shall have NPT threaded ends to ANSI B1.20 or flanged ends to ANSI 816.5. Valve body and all metal components to be manufactured from 304 or 316 type stainless steel. Valves 75mm and larger shall have flanged ends.
- .2 Manual valves shall have locking lever style handle. Refer to electrical specifications for electrical actuator requirements. Valves shall be rated for a working pressure of 1035kPa (150psi).
- .3 Valve shall be of the full or large port type.
- .4 Ball valves shall be manufactured by MAS, series G2 or Mueller GB series or approved equal.

## **2.04 Bolts, Studs and Tie Rods**

- .1 Flange assembly bolts and studs connecting stainless steel in all locations or connecting PVC installed outdoors, below water level or within the freeboard of tanks shall be type 316 stainless steel conforming to Grade 8 ASTM A193.
- .2 Flange assembly nuts connecting stainless steel in all locations or connecting PVC installed outdoors, below water level or within the freeboard of tanks shall type 316 stainless steel conforming to Grade 8 ASTM A194. Use anti-seize compound for all stainless steel bolt ups. Stainless steel washers shall be used for all connections.
- .3 Flange assembly bolts, studs, nuts and washers connecting stainless to galvanized steel or ductile/cast iron shall be 316 stainless steel conforming to Grade 8 ASTM A194/193.
- .4 Tie rods shall be continuously threaded, type 316 stainless steel and conform to Grade 8 ASTM A193/194. Stainless steel washer for all connections.
- .5 For non-potable applications, bolts may be carbon steel, Grade B to ASTM A307, heavy hex style, zinc coating (hot-dip) to ASTM F2329
- .6 Axial stress in bolts shall not exceed 40% or material yield strength based on unthreaded body area.

## **2.05 Butterfly Valves:**

- .1 Butterfly valve locations and sizes are shown on the Drawings.
- .2 Butterfly valve body to be stainless steel, cast or ductile iron, disc and stem to be manufactured from type 304 or 316 stainless steel. Valve shall be resilient seated and utilize EPDM seating.
- .3 Valve shall be rated for a minimum of 1035kPa (150psi) working pressure.

- .4 Ductile or cast iron valve bodies shall be coated with fusion bonded epoxy to all internal and external surfaces. Polyester and nylon surfaced valves will also be accepted providing the meet NSF 61.
- .5 Provide gear actuators on all valves 150mm and larger. Ensure actuators conform to the requirements outlined herein.
- .6 All butterfly valves shall be manufactured by Watts, Bray, Keystone, or approved equal, be lugged treaded style, use EPDM seats and with factory applied epoxy coatings. All gear actuated valves shall be installed with Bray Series 4 Gear operators (or approved equivalent), complete with hand wheel. Refer to electrical specifications for all electrically actuated and electrically actuated modulating valve actuator requirements.

## **2.06 Check Valves (150 LB Class):**

- .1 Check valve locations and sizes are shown on the water treatment plant Drawings.
- .2 Check valves may be wafer or globe style silent check type. Wafer valve body shall have circular grooves matching the bolt pattern of the proposed mating flanges to ensure correct valve positioning. Globe body shall be flanged to class 125 or 150psi. Valve shall utilize a fast closing return silent check mechanism. Check valves shall be manufacturer approved for potable water systems and NSF 61 certified.
- .3 Valve body shall be manufactured from cast iron, ductile iron or stainless steel. Cast or ductile iron surfaces shall be coated in liquid or fusion bonded epoxy. All seats and seal shall be manufactured from EPDM. All springs shall be stainless steel.
- .4 Check valves shall be manufacturer rated for 125 or 150 psig. Valve shall have a wafer style body and accommodate installation between two ANSI style

150lb class flanges.

- .5 Check valves shall be manufacturer by Val-Matic, APca or approved equal.

## **2.07 Component Tagging and Identification**

- .1 Tag all valves and minor equipment with 304 stainless steel tags with 12 mm high engraved letters and numbers. Numbers and letters shall be filled with black paint. Attach to valve with 304 SS chain around valve shaft. Inscription shall contain P&ID identification tag, size, manufacturer and model number.

## **2.08 Couplings (Threaded)**

- .1 Unless specifically noted in the drawings, threaded couplings shall only be used on piping with nominal diameters less than 65mm.
- .2 Screwed joints shall be made using American Standard threads.
- .3 Thread lubricant for threaded joints shall be Teflon tape.

## **2.09 Double Check Valve Assemblies**

- .1 Double check valve assembly location and size has been shown on the Drawings.
- .2 Double check valve shall conform to AWWA C510 requirements, be lead free and be NSF61 approved for potable water applications.
- .3 The assembly shall consist of two positive seating check modules with capered springs and silicon discs. The check module seat and discs shall be replaceable without the need for special tools. Service of all components shall be through a single access cover. The assembly shall have easily accessible testing ports isolated with resilient seated test cocks.

- .4 Double Check Valve body shall be manufactured from bronze or stainless steel. All wetted rubber parts shall be manufactured from EPDM or approved equal seating material. Assembly shall be rated for a minimum working pressure of 1035kPag (150psig).
- .5 The assembly shall be factory ordered with two isolation ball valves. The isolation valves shall be attached to each end of the double check valve assembly. Ensure assembly to be installed with a 20 mesh screen strainer. Strainer to be supplied by double check valve manufacturer and be integral to the overall unit. Strainer to be installed upstream of the check assembly.
- .6 Double check valve assembly shall be manufactured by Watts, Series 007 complete with two (2) Watts supplied isolation ball valves, and Watts supplied strainer or approved equal.

## **2.10 Fittings**

- .1 General
  - .1 Provide fittings of the same material, size and wall thickness as the pipe.
- .2 Chemical piping fittings, refer to section 40 24 00 - Chemical Systems Piping, Valves and Fittings.
- .3 Carbon Steel
  - .1 Weld-end fittings: to ANSI B16.9.
  - .2 Fabricated steel pipe fittings: to AWWA C208.
  - .3 Field welded joints to AWWA C206.
  - .4 Prepare surface, coat and line all fittings same as the pipe in which the fittings are installed.
- .4 Stainless Steel
  - .1 Stainless steel fittings shall conform to AWWA C226, ASTM M03, ASTM A774. Stainless

steel fittings shall be Type 304Lj316L based on design requirements and as indicated on Drawings.

- .2 Stainless steel fabricated specials and fittings shall be fabricated based on the design criteria, fabrication code and the 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 AWWA M11 design manual.

.5 PVC

- .1 PVC shall conform to ASTM D2467 - solvent weld.

## 2.11 Flanges

- .1 Flat faced conforming to the face dimension and drilling of ANSI B16.1, Class 125 for connection to ductile iron or PVC flanges. Use raised face flanges where required. Stainless steel flanges for all potable applications.
- .2 Raised face flanges conforming to the face dimension and drilling of ANSI B16.5, Class 150 or Class 300 for steel or stainless steel or for connection to steel or stainless steel flanges. Use raised face flanges where required. Stainless steel flanges for all potable applications.
- .3 Lap joint Van-Stone style flanges with 304 SS stub ends and backing rings drilled to ANSI B16.5 will be accepted as an alternative for Sch 5 or Sch 10 stainless steel pipe as indicated on the drawings for non-potable non-submerged applications. For dry indoor applications; backing flanges hot dip galvanized. For other applications; backing flanges to be type 304 stainless steel.
- .4 Flanges for mating to equipment or valves shall be



compatible with those items. In all situations similar faced flanges shall only be mated.

- .5 Some equipment may use DIN standard flanges. Adjust mating piping flanges as required.
- .6 Refer to the drawings for the locations of grooved joint, lap joint, slip-on, and weld neck style flanges.
- .7 Adaptor flanges for underground piping for ductile iron, steel, HDPE or PVC pipe connections shall be EBAA, Uni-Flange, Robar, Dresser or approved equal as specified on Contract Drawings and shall be used only where specifically indicated. Flange adaptors shall be installed in accordance with the manufacturer's recommendations.
- .8 Grooved joint flange adaptors shall be Victaulic or approved equal, as indicated on Contract Drawings or as directed by the Departmental Representative and shall be used only where specifically indicated. They shall be installed in accordance with the manufacturers recommendations. Where grooved couplings are used, the wall thickness of the pipe shall be such that the pressure rating remains consistent with adjacent piping.
- .9 Stainless steel flanges shall conform to AWWA C228, ASTM A182, ASTM A240, ASTM A774. Stainless steel flanges shall be Type 304L/316L to AWWA Class D, E, F or ANSI CL 150, or ASTM A774.
- .10 Blind flanges shall be solid Type 304L/316L for potable and submerged applications or hot dip galvanized steel c/w 316L stainless internal lining for non-potable non-submerged applications.
- .11 Coat and line flanges same as the pipe in which they are installed.

## **2.12 Flange Adaptors (Restrained):**

- .1 Restrained Flange Adaptors (Ductile Iron Pipe):  
Shall be manufactured from cast or ductile iron and

be liquid epoxy coated. Restrained method shall be capable of withstanding operating pressures in excess of 1035kpag and surge pressure of 1.5 times operating pressure. Mating flange of stainless steel pipe shall match that of flange adaptor material. Restrained Flange adaptor shall be manufactured by EBAA, 3800, or approved equal.

### **2.13 Flange Gaskets**

- .1 Gaskets for flat faced flanges shall be full face type.
- .2 Gaskets for raised face flanges shall be ring type.
- .3 Gaskets shall conform to AWWA C228 Table 1.
- .4 Gaskets for liquid service to be manufactured from neoprene or EPDM 3.175 mm thick.
- .5 Gaskets for air service to be manufactured from compressed Kevlar with neoprene binder.

### **2.14 Floor Drains (Flush Mounted)**

- .1 Floor drains shall utilize an epoxy coated cast iron body, utilize stainless steel or a nickel bronze resistant strainer, have a cast in place anchor flange, and use a resilient push on rubber gasket system for piping connections.
- .2 Floor drains shall be 50mm in diameter unless otherwise specified. Drains shall be manufactured by Watts, or approved equal.

### **2.15 Floor Drains (Funnel Type)**

- .1 Funnel floor drains shall utilize an epoxy coated cast iron body, utilize an oval shaped funnel, have a cast in place anchor flange, and use a resilient push on rubber gasket system for piping connection. All instrumentation discharge streams shall be directed to drain into funnel. Ensure air gap of 150mm between drain outlet and funnel mouth.

- .2 Funnel floor drains shall be 50mm in diameter unless otherwise specified.
- .3 Drains shall be manufactured by Watts, or approved equal.

#### **2.16 Gate Valves (Plant Service):**

- .1 2.16.1 Gate valves shall conform to AWWA C509 standards for resilient seated gate valves.
- .2 2.16.2 Valves shall have a cast or ductile iron bodies and bonnets. All internal and external metal surfaces shall have liquid or fusion applied epoxy. Valve shall have flanged ends to ANSI B16.1 or 16.5.
- .3 2.16.3 Gate Valves shall have rising stems, open by turning left and include an actuator and hand-wheel.
- .4 2.16.4 Gate Valves shall be rated for a minimum working pressure of 1035kPag (150psig).
- .5 2.16.5 Gate Valves shall have EPDM rubber for seats and seals. Cast iron wedge to be gray iron and completely encapsulated with EPDM rubber. All sealing rubber to be permanently bonded to cast iron wedge and conform to ASTM D429. All rubber o-rings, seats and seals shall be replaceable.
- .6 2.16.6 Valves shall be manufactured by Clow, Crane, or equal complete with hand- wheel, approved equal.

#### **2.17 Grooved Joint Steel Pipe Couplings (Stainless Steel Pipe):**

- .1 Coupling locations and sizes are shown on the Drawings.
- .2 Coupling shall be rated for a minimum of 1035kPa (150psi) working pressure and be the rigid type.
- .3 Couplings shall be manufactured specifically for installation on thin walled, schedule 10, type 304

stainless steel pipe. Pipe shall be roll grooved, cut grooved style couplings will not be accepted. Couplings shall have stainless steel or ductile iron bodies. Ductile iron bodies to have epoxy coatings.

- .4 Ensure grooving process does not compromise wall thickness so that the groove pressure rating remains consistent with adjacent piping. Groove shall be installed as per Victaulic's RX rolling procedure (or similar) to ensure no compromise of pipe wall pressure rating occurs.
- .5 Gasket material shall be manufactured from EPDM materials.
- .6 Couplings shall be manufactured by Victaulic, style 89 rigid coupling, with optional epoxy coated exterior surfaces, complete with grade 'E' EPDM gaskets. Approved equals will be considered providing they meet or exceed the above stated requirements.

## **2.18 Grooved Joint Steel Pipe Couplings (Schedule Carbon Steel Pipe):**

- .1 2.18.1 Coupling locations and sizes are shown on the Drawings.
- .2 2.18.2 Coupling shall be rated for a minimum of 103SkPa (150psi) working pressure.
- .3 2.18.3 All couplers shall have ductile iron bodies with hot dipped galvanized exterior coatings (non potable applications) and epoxy coated for potable applications. All fasteners shall be galvanized.
- .4 2.18.4 Gasket material shall be manufactured from EPDM materials.
- .5 2.18.5 Couplings shall be manufactured by Victaulic, style 07 rigid couplings, with hot galvanized or epoxy coated exterior surfaces, complete with grade 'E' EPDM gaskets.

## **2.19 Hose Bibs (Interior)**

1. Hose bibs shall have 19mm in diameter connections unless otherwise indicated on the Drawings.
- .2 Hose bib body shall be epoxy coated cast iron on brass. Hand wheel shall be epoxy coated cast iron or equal. Connections sizes shown on the Drawings.
- .3 Hose bibs shall be manufactured by Watts or approved equal.

## **2.20 Hose Bibs (Exterior)**

- .1 Hose bibs shall have 19mm in diameter connections unless otherwise indicated on the Drawings.
- .2 Hose bib body shall be epoxy coated cast iron or brass. Hand wheel shall be epoxy coated iron or equal. Connections sizes shown on the Drawings.
- .3 Hose bib and line shall be a free draining, frost free type.
- .4 Hose bibs shall be manufactured by Watts or approved equal.

## **2.21 Needle Valves**

- .1 Needle valves shall have a forged or machined type 316 stainless steel bodies, use EPDM seals, have a dirt/dust thread protection shroud, high strength threads, and have a non-rotating hardened needle for positive shutoff.
- .2 Needle valves shall be capable of a minimum working pressure rating of 1035kPag (150psig). Test pressure capacity shall be a minimum of 1.5 times operating pressure rating.
- .3 Needle valves shall be manufactured by Swagelok or approved equal.

## **2.22 Penetration (Wall and Floor Slabs)**

- .1 Steel and stainless piping extending through

concrete walls of floor slabs shall utilize puddle flanges.

- .2 If coring through an existing slab is necessary a Link-Seal modular sealing assembly shall be used.
- .3 All buried steel and stainless steel piping penetrating through exterior foundation walls shall extend a minimum of 1.0m (preferably 2.0m) prior to transition to PVC or HDPE piping. Cathodically protect all buried steel and stainless steel piping and component's.

## 2.23 Pipe

- .1 Chemical Piping, refer to section 40 24 00 - Chemical Systems Piping, Valves and Fittings.
- .2 Copper Piping .
  - .1 Type K copper piping and fittings to ASTM B88.
  - .2 Use lead free solder on all connections.
- .3 Polyvinyl chloride (PVC) Pipe
  - .1 Schedule 80 PVC pipe to ASTM 01785, (SA 137.3.
- .4 High Density Polyethylene (HDPE)
- .5 2.23.6 Carbon Steel Pipe
  - .1 Unless otherwise specified, steel pipe to be standard wall carbon steel to AWWA C200 or ASTM A53 .
  - .2 Fabricated steel pipe fittings: to AWWA C208 .
  - .3 Field welded joints to AWWA C206 .
  - .4 Wall thickness as shown on Contract Drawings.
- .5 Stainless Steel

- .1 To AWWA C220, ASTM A312, ASTM A778. Stainless steel pipe shall be type 304Lj316L .
- .2 Wall thickness as shown on Contract Drawings. All piping 6Smm diameter and under to be schedule 40. All piping 75mm and large shall be schedule 10 unless otherwise specified .
- .3 Fabricated stainless steel pipe fittings: to AWWA C226.
- .4 Field welded joints to AWWA C206.

## **2.24 Pipe Coatings**

- .1 Coat and line all carbon steel piping.
- .2 Surface preparation: abrasive blast to SSPC SP-10.
- .3 Coatings to extend over cut ends of pipe to edge of flange face or edge of grooved joint coupling.
- .4 For grooved joints extend coating into groove, modifying coating thickness so as to maintain joint integrity as recommended by the grooved joint manufacturer.
- .5 Coatings and Linings (Epoxy)
  - .1 Primer: 1 coat of AWWA approved epoxy primer.
  - .2 Coating and Lining: One or two coats high solids solvenated AWWA C-210 liquid coated of AWWA C-213 fusion bonded epoxy. Approved Epoxy to minimum system thickness of 16-18 mils DFT, immersion service.

## **2.25 Pipe Colour Coding**

- .1 Colour code epoxy coatings of all carbon steel pipe; provide coloured flow arrows on stainless steel piping. Colour coding shall conform with CGSB- 24.3-92. Colour schedule

as follows:

Description	Pipe! Arrow	Letter
Raw Water	Dark Blue	White
Drainage	Dark Grey	Black
Filter	Dark Brown	White
Hot Water	Light Blue with	White
Potable	Light Blue	White

- .2 Place flow arrows every 2.0 meters on centre. Flow arrows shall be large enough to accommodate 38mm high letters indicating the type of fluid conveyed.

## 2.26 Pipe Joints (General)

- .1 For not readily-disassembled joints on steel pipe:
  - .1 65 mm or less use threaded fittings;
  - .2 75 mm or greater use butt welds;
- .2 For readily-disassembled joints on steel pipe:
  - .1 65 mm or less, use unions or groove joints;
  - .2 75 mm or greater, use flanges, grooved joints, or bolted-sleeve couplings (buried only). Flanges may be slip on weld neck as identified on the Drawings.
- .3 Field Welding is not allowed except in exceptional circumstances and must be approved in writing by the Departmental Representative prior to the activity.
- .4 Nipple installation shall not compromise the overall pipe strength.

## 2.27 Pipe Expansion

- .5 Ensure piping and support system accommodate expected changes in ambient, operating and



installation temperatures without damage to piping, appurtenances, equipment or structures.

## **2.28 Pipe Nipples (Welded or Threaded)**

- .6 Install small threaded or welded pipe nipples where specified on the Drawings. Ensure nipple material matches pipe material.

## **2.29 Pipe Support Systems**

- .1 No attempt has been made to indicate every necessary pipe support in the drawings. The intent has been to indicate general arrangements and typical spacing's, but does not relieve the Contractor of the responsibility of designing and supplying a complete support system.
- .2 All pipe shall be supported in accordance with the manufacturer's recommendations.
- .3 Pipe support systems shall be designed to support the operating loads with a factor of safety of 5.0.
- .4 Make provision for expansion, contraction, slope and anchorage.
- .5 Do not support piping from masonry wall construction unless approved by Departmental Representative.
- .6 Do not support piping from equipment or other pipes.
- .7 Where structural bearings are not in suitable locations, provide supplementary structural members.
- .8 Provide hangers and/or base supports within one metre of each change in direction on each leg, on each side of each valve, and on the first spool piece or fitting from a piece of equipment.
- .9 Do not use perforated band, wire chain, or solid ring type hangers.

- .10 Ceiling hangers shall be of the following types:

Pipe Size	Hanger Type
50mm and less	Split
65mm to 75mm	Adjustable
100mm and	Roller or

- .11 Provide ceiling spring hangers where required to offset expansion in horizontal runs which follow long vertical risers.
- .12 Supports shall be fabricated from stainless steel materials and fasteners. Galvanized materials may be used providing anti-galvanic insulators are used. In submerged (including tank freeboard) and exterior applications provide supports, anchors and fasteners manufactured from type 304 or 316 stainless steel.
- .13 Ceiling hanger rod sizing, as a minimum, for all steel and stainless steel pipe shall be as follows:

Pipe Size (nominal mm)	Hanger Rod (mm)
25	10
38	10
50	10
65	12
75	12
100	16
150	19
200	22
250	22
300	25
350	25
400	29
450	32

- .14 Maximum floor and ceiling support spacing for steel or stainless steel piping shall be as listed in the following table:

Pipe Size (nominal, mm)	Steel/Stainless Steel Pipe Support Spacing Cm)
Up to 25	1.8
30 to 50	2.4
65 to 100	2.8
150 to 200	3.0
250	3.5
300 and lamer	3.5

- .15 Length adjustment collars shall be provided for hanger rods. If adequate space exists turnbuckles may also be used.
- .16 Copper tubing up to 15 mm in size shall be supported every 1.8 m on centre. Tuber larger than 15 mm shall be supported every 2.4 m on centre. Provide a double thickness of Plycoflex 310 on Greenline accessory tape between the copper pipe and the supports.
- .17 Threaded expansion type inserts shall be used to connect piping to concrete. Optional capsule anchors when supporting hangers/supports from concrete slabs or walls. Capsule anchors shall be bonded using a two part resin. Capsule anchor shall be manufactured by Hilti or Emhard Molly Parabond and installed as per manufactures recommendations. Anchor capacity shall match or exceed hanger yield strength.
- .18 Aluminium or galvanized steel clips shall be used to support piping from aluminium or steel structural members. If stainless steel pipe is being supported use non conducting nylon (or similar) spacers between the stainless steel and the clips to ensure no dissimilar metal contact.
- .19 Where floor supports are required, use a rigid saddle or flange mounted support system as indicated on the process Drawings. Used non conducting insulators between support and pipe if dissimilar metals are used. Supports shall be manufactured by Standon, styles 589 or 592. Ensure

floor supports are secured to floor with Hilti or approved equal method.

## **2.30 Pressure Relief Valve:**

- .1. Pressure relief valves shall be installed on chemical feed pump skids. Refer to the Process Drawings for details. Relief valve discharge shall be directed to a calibration column drain and pressure relief line, leading back to the appropriate chemical storage tank.
- .2. Pressure relief valve shall be rated for a minimum of 1725kPa (250psi) working pressure.
- .3. Valve shall be a pilot operated pressure relief valve. Valve shall normally closed and open when the pre-set pressure is applied to valve inlet. Valve shall remain open for the duration of high pressure and close automatically upon system pressure dropping below the pre-set value.
- .4. Valve shall be of the globe style. The inner valve assembly shall be top and bottom guided by means of bushings. The only moving valve part shall be the stem which is to be manufactured from stainless steel. Valve cover shall have a separate stem cap giving access to the stem to check for proper alignment.
- .5. All pressure containing components including body shall be constructed of ductile iron to ASTM A536-65. Flanges shall be ANSI B16.5, Class 300. Valve body and flanges shall be internally and externally fusion body epoxy coated to ANIS/AWWA C116/A21.16.
- .6. Valve shall have stainless steel seat and seat ring and be replaceable without special tools. Gaskets and diaphragm shall be manufactured from EPDM materials.

## **2.31 Pressure Reducing Valve:**

- .1. Pressure relief valve location and size is shown on the Drawings.
- .2. Pressure relief valve shall be rated for a minimum of 1035kPa (150psi) working pressure.
- .3. Valve shall be a pilot operated pressure reducing valve. Valve pilot shall sense downstream pressure through a connection at the valve outlet. Under flow conditions, the pilot reacts to changes in upstream pressure to control the valve position by modulating the pressure above the diaphragm. The downstream pressure is maintained virtually and steadily at the pilot set point.
- .4. All valve body components including body shall be constructed of ductile iron to ASTM A536-65. Flanges shall be ANSI B16.5, Class 150. Valve body and flanges shall be internally and externally fusion body epoxy coated to ANIS/AWWA C116/A21.16.

### **2.32 Seats and O-Rings**

- .1. Seats and O-Rings shall be EPDM unless otherwise specified.

### **2.33 Thrust Restraints and Pipe Anchors**

- .1. Pipe movement and the transmission of thrust forces onto equipment flanges or connections shall be prevented by pipe thrust restraints and anchors.
- .2. Thrust restraints shall be designed for thrust loads developed by 2.5 times the maximum test pressure.
- .3. Use stainless steel components, fasteners, tie rods and nuts for potable and submerged conditions (including freeboard) and all rooms with open tanks or channels. Use hot dip galvanized steel components in dry rooms for not potable applications.
- .4. Tie rods to be minimum 19mm diameter. Tie rods larger than 19mm shall be sized so that axial stress in rod does not exceed 40% of material yield

strength.

- .5. Compression coupling joints shall be provided with the rod type thrust harnesses. The harness anchorage shall be in accordance with the latest edition of AWWA M11.
- .6. Refer to structural drawings for details on modifications to existing supports/thrust restraints which are to be modified.
- .7. Details of pipe thrust restraints, harnesses and anchors shall be submitted to the Departmental Representative for review prior to fabrication.

#### **2.34 Transition Couplings - Underground Restrained Type**

- .1. Refer to Process and Civil Drawings for sizing and locations.
- .2. All mechanically restrained couplings shall be of one manufacturer and conform to AWWA/ANSI standards for materials and hydrostatic testing requirements. The coupling shall be specifically designed to accommodate transition between schedule steel/stainless pipe and PVC pressure, sewer pipe and HDPE piping.
- .3. Mechanically restrained couplers to be cast or ductile iron, with all internal and external metal surfaces factory or post factory epoxy coated.
- .4. Mechanically restrained couplers shall be rated for a minimum of 1035kPa (150psi) working pressure. Coupling shall be capable of test pressures to 1.5 times max rated operating pressure.
- .5. Mechanically restrained couplers shall be installed with galvanized steel fasteners unless otherwise noted and be wrapped in Denso tape prior to backfilling.
- .6. When transitioning from HDPE pipe, use stainless steel insert stiffeners on HDPE side.
- .7. Mechanically restrained couplers to be manufactured

by EBAA, model 3800 Mega-Coupling, or approved equal.

### **2.35 Transition Couplings - Underground Unrestrained Type**

- .1. Refer to Process and Civil Drawings for sizing and locations.
- .2. All transition couplings shall be of one manufacturer and conform to AWWA/ANSI standards for materials and hydrostatic testing requirements. The coupling shall be specifically designed to accommodate transition between schedule steel/stainless pipe and PVC pressure or sewer pipe.
- .3. Transition couplers to be cast or ductile iron, factory or post factory epoxy coated to all internal and exterior metal surfaces.
- .4. Transition couplings shall be rated for a minimum of 1035kPa (150psi) working pressure.
- .5. Transition couplings shall be installed with galvanized steel fasteners unless otherwise noted wrapped in Denso tape prior to backfilling.

### **2.36 Valve Actuators (Manual Lever, Manual Hand-Wheel or Manual Chain-Wheel)**

- .1. Provide lever actuators for quarter turn valves. Valve operator to be perpendicular to the pipe run when the valve is closed.
- .2. Provide lever operator for ball valves less than 150 mm diameter and butterfly valves less than 150 mm diameter (or as per manufacturer's recommendations).
- .3. Provide hand-wheel actuator for valves 150mm in diameter and larger.
- .4. Maximum pull on the end of the lever arm or at the rim of a hand-wheel not to exceed 300 N (67 lbs) when one side of the valve is at test pressure and one side is at atmospheric pressure. If greater

force is required, provide a gear operator.

- .5. Provide valve stem extensions where additional clearance is required for pipe insulation or where operation without the extension is difficult. Stem extensions to be same material as valve stem.
- .6. Minimum hand wheel diameter:
  - .1 38mm valve: 75 mm hand-wheel
  - .2 50mm valve: 85 mm hand-wheel.
- .7. Minimum lever operator length:
  - .1 25mm valve: 125 mm lever .
  - .2 38mm to 65 mm valve: 150 mm lever
  - .3 75 mm valve: 175 mm lever
  - .4 100 mm valve: 225 mm lever
  - .5 150 mm valve: 250 mm lever
  - .6 200 mm valve: 300 mm lever
- .8. Where indicated on the drawings, provide chain-wheel actuators .
  - .1 Provide direct mount cast iron chain wheel.
  - .2 Design actuators so a force of 150N is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. If greater force is required, provide a gear type chain operator.
  - .3 The chain pulley shall mesh positively with the chain .
  - .4 Extend chain from the valve operator to operating height 1.2 m above the floor or as directed by the Departmental Representative. Exact dimensions to be field determined.
  - .5 Provide chain hooks where required, and



stands for chain hooks where necessary to prevent chain from hanging within traffic paths

.6 Where required provide actuator position switch. Refer to electrical for further requirements.

.7 Chain, hook and stand to be stainless steel.

### **2.37 Valve Actuators (Manual Gear)**

- .1 Actuators shall be manufactured in accordance with AWWA C504.
- .2 Provide manual gear actuators for valves not specified to have a manual lever or hand-wheel actuator.
- .3 Gear operator to be worm gear type equipped with a non-rising stem hand-wheel and a visual indicator of the valve position. Gear operators shall be grease lubricated. Where gear operators are intended for direct bury or submergence, seal units with long life lubricant
- .4 2.37.4 Equip operators with mechanical stop-limiting devices to prevent overtravel of the disc, ball or plug in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Mechanical stops will withstand an input torque of 450 lbs. against the stop. The actuator shall be able to provide 1.25 times the required operating torque under full rated line pressure combined with a flow velocity of 2.4 m/s
- .5 Maximum pull at rim of hand wheel with gear operator - 300 N (67 lbs).
- .6 Manual operators for buried service valves to include an AWWA operating nut and be gasketed and grease packed for submerged operation at water pressures up to 700 kPa. Where angle valve stem extensions are employed, they shall be angle

geared. Provide valve stem extension to surface with cast iron valve box and rock plate.

.7 Where required provide actuator position switch. Refer to electrical for further requirements.

.8 Actuator body to be exterior epoxy coated.

### 2.38 Valve Actuators (Electric)

- .1 Actuator power input shall utilize three phase 600 volts.
- .2 The actuator shall have communication capabilities of either MODBUS RTU or TCP/IP for remote control, status and alarm conditions. The actuator shall also have six (6) hardwired digital inputs for remote control (Open, close, stop/maintain, emergency shutdown, open and closed interlock), and 4 independent sets of contacts to monitor position, .status, valve alarms and positioner alarms.
- .3 A manual override requiring a de-clutchable mechanism is required. Orientation of valve as per mechanical drawings or to allow for the greatest degree of hand wheel access.
- .4 NEMA 4/4X/6 enclosure rating with CSA (C-US) and CE.
- .5 Anodized aluminium with epoxy powder coated body.
- .6 Installed complete with adaptor plate for installation directly to the type of valve being used.
- .7 Over temperature motor thermostat.
- .8 Non-intrusive selector switches integral to the actuator shall be part of the actuator to provide for Local/Stop/Remote selection and Open/Close control.

- .9 The actuator shall contain all motor controls including reversing contactor, power supplies to convert 600 volt power supply to control voltage levels, any associated circuit boards and terminals for power and control wiring.
- .10 Electric actuators shall be rated for the area classification where they are installed. Actuators installed in the Headworks building shall be rated for a Class 1 Zone 0 environment, all others shall be rated Class 1 Zone 2.
- .11 The actuator shall be capable of being commissioned and interrogated without removing the electrical covers via an infra-red setting tool. The actuator shall have a display that can be observed through a viewing window and all function of the actuator can be displayed by the setting tool. All actuator functions can be checked and changed if needed using the setting tool. Settings can be password protected to limit access to selected personnel. Provide one (1) setting tool as part of this contract.
- .12 Electric Actuators shall be manufactured by Emerson, Rotork or approved equal. All actuators shall be by the same manufacturer.

## **2.39 Vacuum Break Valves**

- .1 The location and sizing of the vacuum break valves has been shown on the Process Drawings.
- .2 The valve shall open in response to a 0.25 psi relative vacuum.
- .3 Vacuum valve shall have resilient seating. Seating an gasket materials shall be suitable for the intended application. Materials shall be suitable for potable water applications.
- .4 Valve shall have a hood with inlet screen to prevent debris from entering the valve. Valve shall have an inflow prevention mechanism to prevent water from entering the pipeline.

- .5 Vacuum valves shall be rated for a minimum of 1035 kPag or 150 psig.
- .6 Vacuum valves shall be manufactured by Val-Matic, Series 100VB or approved equal.

### **3 EXECUTION**

#### **3.01 Preparation**

- .1. Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
- .2. Make all minor modifications to suit installed equipment and structural element locations and elevations.
- .3. Advise the Departmental Representative of all modifications. Do not commence work on the related piping until the Departmental Representative's approval has been received.

#### **3.2 Pipe Handling**

- .1. Each pipe and fitting shall be inspected prior to installation. Damaged pipe or pipe with damaged protective coatings shall not be installed.
- .2. Remove all foreign matter from inside of pipe prior to installation.
- .3. Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.
- .4. Prevent stainless steel from contacting carbon steel during storage and handling.

#### **3.3 Conflicts**

- .1. Confirm the routing of each section of pipework with the Departmental Representative prior to commencement of installation. Advise the

Departmental Representative of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict, as approved by the Departmental Representative.

### **3.4 Welding**

- .2. Welding shall conform to the ASME Boiler and Pressure Vessel Code, Section 8 - Unfired Pressure Vessels, and Section 9 - Welding Qualifications. Such welding shall be carried out by a fabricator fully approved by the Canadian Welding Bureau, under the requirements of CSA Z662.
- .3. In addition, field welding shall conform to the general requirements of AWWA C206 "Field Welding of Steel Water Pipe Joints".
- .4. Field welding shall be kept to a minimum and performed only with the prior consent of the Departmental Representative. Welding shall not be done when the quality of the completed weld would be impaired by prevailing weather conditions such as moisture, blowing sands, high winds or low temperatures. The use of wind shields and tents may make conditions for welding satisfactory. If the Departmental Representative's opinion, protection from prevailing weather conditions is necessary, then all welding shall cease until this protection has been erected.
- .5. When the ambient temperature is below OOC all welding operations shall cease unless an appropriate welding procedure has been qualified.
- .6. Metal surfaces in and adjacent to the welding groove shall be dry before welding commences and kept dry and free from dirt, loose scale, slag, grease or any other foreign contaminant.
- .7. In general, field joints shall be of the butt type, suitably bevelled per the weld procedure. The end of each pipe shall be carefully fitted to butt accurately with proper gap to the preceding one. Before placing the pipe in position, the ends of

the pipe shall be made truly circular by an approved method and, if necessary, for large pipes "spiders" shall be placed in each to keep them truly circular.

- .8. Pipes cut in the field for closing pieces and other field joints shall be cut with an approved cutting torch to a smooth uniform level.
- .9. The edges shall be smooth and not serrated and shall be ground smooth if they are rough after cutting.
- .10. Spot-radiographic inspection of welds, or alternative method, may be conducted at the option and at the expense of the Owner. The Departmental Representative will designate such company to carry out inspection of welds at the site of erection, and the Contractor shall provide labour and working space as may required. Radiographic procedure and interception shall be in accordance with Item UW-52 or Section 8 of the ASME Code. Field welding judged unacceptable shall be repaired by the "carbon-arc gouging" process, to the satisfaction of the Departmental Representative at no additional cost to the Owner.
- .11. All welds after welding is complete must be cleaned and surface prepared as required by either AWWA C210 for epoxy coatings or AWWA C222 for polyurethane coatings.
- .12. For epoxy lined and/or coated or polyurethane lined and/or coated piping patching material approved by the coating manufacturer shall be applied to the joints after surface preparation is complete by an applicator certified by the coating manufacturer.

### **3.5 Stainless Steel Fabrication**

- .1. The majority of stainless steel welding shall be in 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 piping shall not have been used on previous carbon steel work.

- .2. Groove stainless steel pipe in accordance with grooving machine manufacturer's instructions. Thread stainless steel pipe in accordance with threading machine manufacturer's instructions.
- .3. Only 300 series stainless steel brushes or wheels shall be used on austenitic and nickel alloys. Areas used for fabrication of austenitic and nickel alloys shall be separated from carbon steel areas by methods suitable to prevent contamination by carbon steel shavings, grinding dust and zinc dust from painting operations. Where tape is used for backing purge gas the tape shall use an adhesive backing such that when no longer required can be completely removed with residual adhesive removed by a suitable solvent or abrasive.
- .4. Shop fabricated fittings made from rolled stock in accordance with ASTM A240 shall be in a solution annealed condition. Shop fabricated fittings made from pipe shall be in accordance with AWWA C220, ASTM A312, and ASTM A778. Design standard shall be in accordance with AWWA C226 and thickness of all reinforcement collars and pads will be determined by the appropriate formula in the latest addition of AWWA M11 manual.
- .5. Welding Procedures
  - .1. All welding of the root pass of austenitic stainless steel pipe shall be done using the Gas Tungsten Arc Weld (GTAW) process with shielding gas protection on the backside of the weld sufficient to reduce oxygen content to a level that can avoid granulation and ensure a high quality corrosion resistant weld. Large bore piping may be internally back welded to achieve the same result. The Shield Metal Arc Weld (SMAW) process may only be used for fill passes or fillet welds or in

situations where the Departmental Representative determines it is not possible to use the GTAW process .

- .2. Stainless pipe shall be cleaned with alcohol or acetone to a pre-weld zone extending 50 mm on either side of the weld .
- .3. Fabricator shall provide the Departmental Representative with a welding procedure prior to commencing any work .
- .4. If requested, fabricator shall provide the Departmental Representative a demonstrated fillet and butt weld on a test sample of pipe to be examined and approved by a certified inspection company. The test specimens will be submitted to the Departmental Representative's inspection company at the Owner's expense. Any re-testing required by the Owner shall be completed at the Contractor's expense .
- .5. All pipe welding shall be in accordance with ASME B31.3 normal fluid service code for pressure piping.

### **3.5.6 Post Weld Cleaning**

- .1. All stainless steel welds shall be pickled and passivated in accordance with AWWA C220, ASTM A380 and STM A967. Stainless piping shall be immersed in a liquid bath of pickling solution that is NSF 61 certified for drinking water. Large bore piping shall be cleaned with a pickling paste that is NSF 61 certified for drinking water. Any noticeable discolouration found on the stainless pipe shall also be removed by pickling .
- .2. Once sufficient pickling time has elapsed the passivated surface shall be cleaned of all acids by thoroughly rinsing the pipe.

### **3.6 Inspection**

- .1. The Contractor shall provide shop visual inspection for each weld to reveal any surface or root



defects, unacceptable weld fit-ups, arc strikes, weld splatter or insufficient heat tint removal.

- .2. The Departmental Representative may use any method of inspection necessary to establish quality control and ensure adherence of welding procedures.

### **3.7 Interior Pipe Installation**

- .1. Piping installed in interior building spaces shall be fabricated and installed in accordance with AB Building Code Statutes and Regulations.
- .2. Make adequate provision in piping runs for expansion, contraction, slope, and anchorage.
- .3. Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag and stress.
- .4. Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.
- .5. Accurately cut all piping for fabrication to field measurements.
- .6. Pipes shall be installed in straight alignment. Variance from the true alignment shall not exceed 10 mm in any direction. Pipe runs shall be fabricated and assembled to ensure that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment shall not be permitted. The Contractor shall undo and subsequently remake all pipework connections where so instructed by the Departmental Representative to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.
- .7. Do not cut or weaken the building structure to facilitate installation.
- .8. Provide minimum of 150 mm to face or 200 mm to edge of flanges to walls, floor or ceiling unless shown

otherwise.

- .9. Provide minimum 100 mm to face or 150 mm to edge of grooved joint
- .10. Provide readily disassembled joint at 150 mm of either side of wall or floor penetration unless shown otherwise.

### **3.8 Pipe Through Walls and Floors**

- .1. Provide a puddle flange for all cast in place penetrations of exterior walls and floors, and tank walls and floors. Provide puddle flanges with typical dimensions as shown on the Drawings.
- .2. Refer to Structural Drawings and specifications for additional waterproofing and reinforcing requirements for all pipe wall and floor penetrations.

### **3.9 Buried Pipe Transition at Foundation Perimeter**

- .1. Provide a manufacturer supplied stiffening insert for all HDPE transitions requiring a transition coupling.
- .2. Wrap all transition couplings in Denso tape prior to backfilling.

### **3.10 Sleeves**

- .1. Sleeves shall be provided where piping passes through a wall floor or ceiling and a watertight seal is not required.
- .2. Co-operate with other divisions to locate and place sleeves or cast-in-place pipe sections prior to the construction of concrete and masonry building elements.

### **3.11 Flow Meters (Mag Types)**

- .1. Ensure that all mag type meters are installed as per the layout dimensions shown on the drawings. Ensure manufacturer upstream and downstream straight pipe run requirements are achieved. For typical installation ensure that a minimum of 5 upstream and 2 downstream pipe diameters remain

clear of fitting or bends.

### 3.12 Valves

- .1. Exterior Coating and Identification
  - .1. Use manufacturer standard or optional supplied exterior coatings .
  - .2. Tag all valves as per the P&ID numbering .
  - .3. Interior valve tagging: Printed vinyl coated pressure sensitive cloth tape. Use Type B-500 Manufactured by W.H. Brady of Canada Ltd. or approved equal. Letters sizes shall be 20mm high for pipes under 75mm and 40mm high for pipes over 75mm .
  - .4. Exterior and within tanks and tank freeboard valve tagging: 304 stainless steel tags with 12 mm high engraved letters and numbers with letters and numbers filled with black paint. Attach to valve with 304 SS chain around valve shaft.
- .2. Orient valves as per mechanical drawings or to allow for the greatest degree of actuator access.
- .3. Testing
  - .1. All valves shall be substantially watertight and shall be shop tested according to current applicable AWWA or equivalent.
  - .2. Field test all valves as per manufactures recommendations. Test for correct valve function and actuation as well as pressure testing as part of the pipeline system.
- .4. Spare Parts
  - .1. For buried valves, provide one key to operate valves or equivalent.

### 3.13 Insulation

- .1. Insulation and surfaces to be clean and dry when

installed. Remove any damaged materials and replace with new materials.

- .2. Apply insulation materials, accessories and finishes in accordance with manufacturers recommendations and as specified.
- .3. Extend exterior insulation system through exterior wall to interior of building as shown on drawings.

### **3.14 Threaded Joints**

- .1. Ream the end of all pipes to remove all burrs and cuttings when fabricating threaded joints.
- .2. Clean out pipe prior to joining.
- .3. Apply Teflon tape to male threads and join pipe. Do not use extra tape to make up for slack in the joint.
- .4. Pipelines shall be installed with as few joints as possible. Short lengths of pipe coupled together shall not be used.
- .5. If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied.
- .6. Threads shall not be caulked.
- .7. Bushings shall not be used.
- .8. Nipples in screwed piping shall be shoulder nipples. Close nipples shall not be used unless specifically indicated.

### **3.15 Flanged Joints**

- .1. Flanges and gaskets shall be cleaned prior to connection.
- .2. Gaskets shall be lubricated with soapy water and anti-seize compound shall be applied to the bolts.
- .3. Bring flanges into close parallel and lateral alignment.
- .4. Bolts shall be tightened progressively. Bolt

tightening shall proceed from side to side of the flange. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nut and bolt heads.

- .5. 3.16.5 Washers may not be used to take up excess bolt length.
- .6. 3.16.6 Bolt projection beyond nuts shall be approximately two full threads.
- .7. 3.16.7 Align flanges which connect piping to mechanical equipment to close parallel and lateral alignment prior to tightening bolts. Do not place undue strain on the equipment.

### **3.16 Grooved Joints**

- .1. Install grooved joints as recommended by manufacturer using manufacturer's recommended lubricants on gaskets.
- .2. Ensure grooving process does not compromise wall thickness so that the groove pressure rating remains consistent with adjacent schedule 10 piping.  
Groove shall be installed as per Victaulic's RX rolling procedure (or similar) to ensure no compromise of pipe wall pressure rating occurs.

### **3.17 Connections to Existing Piping and Equipment**

- .1. The Contractor shall be responsible for verifying fit and materials at each connection location prior to making the connection.
- .2. Any modifications to either new or existing materials or fittings required to make the connections shall be approved by the Departmental Representative prior to the connections being made.
- .3. Where joining piping to existing equipment, the Contractor shall confirm the type of flanges on the equipment and install matching flanges to suit.

### **3.18 Pressure Testing**

- .1. Give Departmental Representative 24 hours notice of testing.
- .2. Do not insulate or otherwise conceal work until piping systems are tested and accepted.
- .3. Supply all water required for pressure testing.
- .4. Supply all pumps, compressors, gauges, etc. required for testing.
- .5. Where necessary, install air threadolets, air relief valves and line fitting valves as necessary to complete testing. Remove after testing and plug the threadolets.
- .6. Cap or plug all lines which are normally open ended. Remove on completion of testing.
- .7. Test all underground lines prior to backfilling. Do not place concrete surround until lines are tested.
- .8. Isolate all low pressure equipment and valves during testing so as not to place any excess pressure on the operating equipment.
- .9. Where defective material or equipment is identified, repair or replace using new material.
- .10. Flush and drain liquid pipes after pressure tests. Purge all gas pipes after pressure tests.
- .11. Dispose of flushing water in manner which causes no damage to buildings or siteworks in a manner approved by the Departmental Representative.

### **3.19 Pressure Testing of Liquid Lines**

- .1. All proposed pressure piping that is to convey liquid shall be hydrostatically pressure tested.
- .2. Hydrostatic pressure and leakage testing of piping that is to convey air is acceptable if approved by the Departmental Representative. Contractor must provide any additional piping support required for the additional testing loads if using liquid to pressure test air lines. Test duration for air piping is four hours.

- .3. Perform hydrostatic pressure and leakage testing of above ground piping as follows:
  - .1. All pressure testing shall be done in the presence of the Departmental Representative.
  - .2. Perform testing of welded steel piping to AWWA C200
  - .3. The duration of the test shall be 2 hrs .
  - .4. Prior to hydrostatic testing or disinfection, all water retaining structures, pipework and conducts shall be thoroughly cleaned.
  - .5. If required, safety relief valves shall be supplied with test gags for hydrostatic testing purposes. Upon completion of testing, the gags shall be removed and the system shall be repressed to the relieving pressure of the relief valves to ensure proper valve operation.
  - .6. Test pressure shall be a minimum of one and one-half times the proposed system working pressure.
  - .7. Maintain system pressure to within  $\pm 3.0$  kPa of test pressure throughout the duration of the test without the addition of make-up water.
  - .8. Visually inspect all joints and flanges. There should be no visual evidence of leakage throughout the duration of test. Zero leakage is required.

### **3.20 Pressure Testing of Air Lines**

- .1. All lines normally used for the conveyance of gases shall be pressure tested.
- .2. Dry air or commercial grade nitrogen shall be used for testing.

- .3. All tests shall include a preliminary check out no more than 50 kPa. Pressure shall be gradually increased in steps.
- .4. Test shall be to one and one-half times the maximum pipe operating pressure for a duration of four hours.
- .5. Provide pressure relief valves to protect equipment and piping from damage and to ensure personnel safety during the test.
- .6. All joints shall be wetted using a mixture of soap and water. There shall be no obvious evidence of leakage.

### **3.21 Disinfection**

- .1. Lines intended for potable water service shall be flushed, disinfected, and bacteriological tested in accordance with AWWA C651. Bacteriological testing and reporting to include total coliforms, fecal coliforms, and background colonies on the total coliform plate. The presence of any coliform bacteria or background bacteria over 200 colony forming units shall constitute a failed test.

**END OF SECTION**



## **1 GENERAL**

### **1.01 General**

- .1 These specifications apply to chemical related system piping, valves, fittings and appurtenances related to system conveying:

- .1 Liquid Sodium Hypochlorite (6% Conc.)

### **1.2 Reference Sections**

- .1 Section 46 30 00 - Water Systems Chemical Feed Equipment

### **1.3 Applicable Works**

- .1 This Section applies to all piping:
  - .1 Above Ground
  - .2 Piping located inside facilities

### **1.04 SCOPE**

- .1 Provide complete, fully tested and operational chemical system components and materials to meet requirements described herein and in complete accord with applicable codes and ordinances.

### **1.5 Submittals for Review**

- .1 Before fabrication, provide manufacturer data for each type of pipe aterial and for each fitting.
- .2 Before fabrication, provide shop drawings for fabricated fittings.
- .3 Before delivery to site provide manufacturer data for each valve, coupling, expansion joint, guide and appurtenance used to complete the work covered in this section.
- .4 Shop Drawings: Shop drawings for all piping systems greater than 19mmø, shall be furnished prior to fabrication. Indicate in orthogonal and/or isometric drawings as required to furnish the assembly details, solvent weld joint placement, vents, drains, instrument connections, supports, anchors, and the provisions for thrust and seismic

restraint as well as any other pertinent details.

- .5 Do not commence work on items requiring submittals until engineer's review is complete.

## **2 PRODUCTS**

### **2.01 BACKPRESSURE VALVES**

- .1 The backpressure valve type shall remain closed (normally closed) until the inlet pressure reaches the set pressure which will then open the valve. The valve shall maintain the set pressure on the upstream side of the valve during normal pumping operations
- .2 Valve shall specifically be manufactured for use on chemical conveyance systems.
- .3 Back pressure valve shall be rated for up to 1035kPag (150psig) working pressure. Backpressure adjustment shall be from 0kPag to 100kPag.
- .4 Back pressure valve material, seals and gaskets, shall be specific to each chemical application. Refer to the material compatibility schedule in Section 40 23 01.
- .5 Back pressure valves shall be manufactured by Chemline, PLAST-O-Matic, PEP, etc
- .6 Backpressure valve locations and sizes will be shown on the Shop Drawings where required.

### **2.02 BALL VALVES**

- .1 Ball valves locations and sizes shown on the Drawings.
- .2 Ensure that all check valve materials including body, seal, seats, fasteners, etc. conform to the requirements summarized in Section 40 23 01, chemical compatibility.
- .3 Ball valves for general chemical use shall be socket ends for 65mm diameter and smaller and flanged ends for 75mm and larger.
- .4 5.2.4 Valve shall be full ported and rated for 1035 kPag. (150psig).
- .5 5.2.5 Valves used for sodium hypochlorite systems shall

be the vented type.

- .6 5.2.6 Valves shall be manufactured by Chemline, PLAST-O-Matic, PEP, etc.

## 2.03 Check Valves

- .1 Check valves locations and sizes shown on the Drawings.
- .2 Ensure that all check valve materials conform to Section 40 23 01.
- .3 Check valves for general chemical use shall be shall use socket ends for 65mm diameter and smaller and flanged ends for 75mm and larger.
- .4 Check valve shall be full ported and rated for 1035 kPag. (150psig).
- .5 Check valves shall be manufactured by Chemline, PLAST-O-Matic, PEP etc.

## 2.04 Component Tagging and Identification

- .1 Tag all valves and minor equipment with 304 stainless steel tags with 12 mm high engraved letters and numbers. Numbers and letters shall be filled with black paint. Inscription shall contain P&ID identification tag, size, model and manufacturer.

## 2.05 General Material Compatibility Requirements

- .1 Hypochlorite solution: Use CPVC or PVC plastics, Viton seals and gaskets and Hastelloy metals if required.

## 2.06 Couplings (Flexible Treaded)

- .1 Install flexible connections at tote or tank piping outlets allow for easy removal of tank. Couplings shall be camlock or quick type. Ensure assembly materials conform to Section 40 23 01.

## 2.07 Fittings, Joints, and Piping

- .1 Provide fittings of the same material, size and wall thickness as the pipe.
- .2 Chemical piping routing has been shown on the layout drawings.

- .3 Unless otherwise specified all piping shall be schedule 80.
- .4 Ensure that piping materials conform to the requirements summarized in the compatibility section outlined herein.
- .5 Schedule 40 and 80 PVC materials shall be Type 1, Grade 1, conforming to ASTM D1784 and D1785, sockets and pressure rating to ASTM D2672 and 2467.
- .6 Schedule 40 and 80 CPVC materials shall be Type 4, Grade 1, conforming to ASTM D1784, ASTM F441/442, sockets and pressure rating to ASTM D2672. All solvent weld joints shall be utilize XIRTEC 24 Industrial CPVC cement by IPEX manufactured specifically for resistance to hypochlorite solution. Solvent weld cement shall conform to ASTM F4933.
  - a. Sodium Hypochlorite - use XIRTEC primer and XIRTEC 24 cement or approved equal
- .7 For joints on plastic and thermoplastic pipe:
  - a. Permanent, no future disassembly required: Use socket welded joints .
  - b. Temporary, future disassembly required: Use flanged joints.
- .8 For readily-disassembled joints on steel pipe:
- .9 Provide flexible tubing where indicated on the Process Drawings. Use stainless steel braided over flexible tubing material is compatible with the specific application. Refer to Section 40 23 01 for material requirements.

## 2.08 Flanges

- .1 Flanged joints will be required on piping 65mm in diameter and larger. Flanges shall be socket weld type. Flange pressure, dimensions and bolt patterns shall conform to AN SI 816.5. Ensure gasket material conforms to the requirements summarized in the compatibility section outlined herein. Flange schedule to match piping schedule.
- .2 Van-Stone style PVC or CPVC flanges with slip

socket connections will be acceptable.

- .3 Flanges for mating to equipment or valves shall be compatible with those items. In all situations similar faced flanges shall only be mated. Ensure that connection to metallic valve fittings utilizes flat faced connections only. Raised face flanged equipment for flat faced PVC flange connections will not be accepted.
- .4 Flange assembly bolts shall be type 316 stainless steel conforming to Grade 8 ASTM A193. Flange assembly nuts shall be type 316 stainless steel conforming to Grade 8 ASTM A194. Stainless steel washers shall be used for all connections.

#### 2.09 Flange Gaskets

- .1 Gaskets for PVC and CPVC flanges shall be 3.2mm thick and full faced.
- .2 Flange gaskets for the various systems shall utilize the following materials:
  - a. Sodium hypochlorite - Viton gaskets.

#### 2.10 Foot Valves

- .1 Foot valves shall be installed on all tote and tank suction piping.
- .2 Ensure that all foot valve materials conform to the requirements the requirements summarized in the materials compatibility section outlined in Section 40 23 01.
- .3 Foot valves shall use socket end connections.
- .4 Foot valves shall use flanged in the event of future removal requirements. Valves shall use a ball type backflow prevention mechanism.
- .5 Foot valves shall be manufactured by Chemline, PLAST-O-Matic, PEP etc.

#### 2.11 O-rings, seats and seals

- .1 Internal component o-rings, seats, seals, etc. shall

conform to chemical compatibility requirements outlined in Section 40 23 01.

## 2.12 Pipe Nipples for Instrument Connections

- .1 Use tee fittings for instrument and analysis element installation. Tapped threaded penetrations into the pipe wall will not be acceptable.

## 2.13 Pipe Support Systems

- .1 5.13.1 No attempt has been made to indicate every necessary pipe support in the drawings. The intent has been to indicate general arrangements and typical spacing's, but does not relieve the Contractor of the responsibility of providing a complete support system.
- .2 All pipe shall be supported in accordance with the manufacturer's recommendations
- .3 Refer to drawing for typical plastic pipe support spacing.
- .4 Provide hangers and/or base supports within one metre of each changer in direction on each leg, on each side of each valve, and on the first spool piece or fitting from a piece of equipment.
- .5 Ceiling hangers shall be of the following types:

Pipe Size (nominal, mm)	Hanger Type
50mm and less	Split adjustable ring
65mm to 75mm	Adjustable Clevis
100mm and greater	Roller or Adjustable Clevis

- .6 Supports and related hardware shall be manufactured from type 204 or 316 stainless steel
- .7 Ceiling hanger rod sizing, as a minimum, for all plastic and thermoplastic pipe shall be as follows:

Pipe Size (nominal, mm)	Hanger Rod Diameter (mm)
25	10
38	10
50	10

- .8 Maximum floor and ceiling support spacing for steel or stainless steel piping shall be listed in the following table:

Pipe Size (nominal, mm)	Steel/Stainless Steel Pipe Support Spacing (m)
Up to 25	1.8
30 to 50	2.0

- .9 Threaded expansion type inserts shall be used to connect piping to concrete. Optional capsule anchors when supporting hangers/supports from concrete slabs or walls. Capsule anchors shall be bonded using a two part resin. Capsule anchor shall be manufactured by Hilti or Emhard Molly Parabond and installed as per manufactures recommendations.
- .10 Aluminium or galvanized steel clips shall be used to support piping from aluminium or steel structural members.
- .11 Where floor supports are required, use a rigid saddle or flange mounted support system as indicated on the process Drawings. Floor supports shall be manufactured by Standon, styles S89 or S92. Ensure floor supports are secured to floor with Hilti or approved equal method.

#### 2.14 Thrust Restraint and Pipe Anchors

- .1 Pipe movement and the transmission of thrust forces onto equipment flanges or connections shall be prevented by pipe thrust restraints and anchors. Such restraints shall be designed and provided the Contractor as required.
- .2 Thrust restraints shall be sized for thrust loads developed by 5.0 times the maximum test pressure.

### 3 EXECUTION

#### 3.01 Preparation

- .1 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
- .2 Make all minor modifications to suit installed equipment and structural element locations and elevations.
- .3 Advise the Departmental Representative of all modifications. Do not commence work on the related piping until the Departmental Representative's approval has been received.

### 3.02 Pipe Handling

- .1 Each pipe and fitting shall be inspected prior to installation. Damaged pipe shall not be installed.
- .2 To ensure chemical contamination does not occur remove all foreign matter from inside of pipe prior to installation.

### 3.03 Conflicts

- .1 Confirm the routing of each section of pipework with the Departmental Representative prior to commencement of installation. Advise the Departmental Representative of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict, as approved by the Departmental Representative.

### 3.04 Socket Welded Joints

- .1 Install all piping and fittings as per manufacturer's recommendations
- .2 Apply solvent weld primer then cement as per manufacturers recommendations.
- .3 Properly align all joints. All misaligned joints upon system inspection will require correction at the Contractors expense.



- .4 Allow manufacturer initial set time prior to handling joint. Carefully handle joint after initial setup. Allow for manufacturers recommended joint cure times before final installation or stressing pipe assembly.

### 3.05 Inspection

- .1 The Departmental Representative may use any method of inspection necessary to establish quality of the installation procedure.
- .2 If equipment fails to meet the performance requirements, immediately make the necessary repairs, replacements, modifications and adjustments to ensure equipment functions as intended at no additional cost to Owner.

### 3.06 Interior Pipe Installation

- .1 Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag and stress.
- .2 Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.
- .3 Accurately cut all piping for fabrication to field measurements.
- .4 Pipes shall be installed in straight alignment. Variance from the true alignment shall not exceed 10 mm in any direction. Pipe runs shall be fabricated and assembled to ensure that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment shall not be permitted. The Contractor shall undo and subsequently remake all pipe work connections where so instructed by the Departmental Representative to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.
- .5 Do not cut or weaken the building structure to facilitate installation.
- .6 Provide readily disassembled joint at 150 mm of either side

of wall or floor penetration unless shown otherwise.

### 3.07 Pipe Through Walls and Floors

- .1 Provide PVC sleeving through wall or floor slabs. Fill space between conveyance piping and sleeve with expandable foam. Ensure filling product is compatible with piping material.
- .2 Co-operate with other divisions to locate and place sleeves or cast-in-place pipe sections prior to the construction of concrete and masonry building elements.

### 3.08 Valves

- .1 Tag all valves as per the P&ID numbering. Include valve size, manufacturer and model.
- .2 Orient valves as per mechanical drawings or to allow for the greatest degree of operator access.
- .3 Field test all valves as per manufactures recommendations. Test for correct valve function and actuation as well as pressure testing as part of the pipeline system.

### 3.09 Flanged Joints

- .1 Flanges and gaskets shall be cleaned prior to connection.
- .2 Gaskets shall be lubricated with soapy water and anti-seize compound shall be applied to the bolts.
- .3 Bring flanges into close parallel and lateral alignment.
- .4 Bolts shall be tightened progressively. Bolt tightening shall proceed from side to side of the flange. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nut and bolt heads.
- .5 Washers may not be used to take up excess bolt length.
- .6 Bolt projection beyond nuts shall be approximately two full threads.

- .7 Align flanges which connect piping to mechanical equipment to close parallel and lateral alignment prior to tightening bolts. Do not place undue strain on the equipment.

### 3.10 Pressure Testing

- .1 Give Departmental Representative 24 hours notice of testing.
- .2 Do not insulate or otherwise conceal work until piping systems are tested and accepted.
- .3 Supply all water required for pressure testing.
- .4 Supply all pumps, compressors, gauges, etc. required for testing.
- .5 Cap or plug all lines which are normally open ended. Remove on completion of testing.
- .6 Isolate all low pressure equipment and valves during testing so as not to place any excess pressure on the operating equipment.
- .7 Where defective material or equipment is identified, repair or replace using new material.
- .8 Flush, drain and dry chemical lines with compressed air after pressure tests.

### 3.11 Pressure Testing of Chemical Lines

- .1 All proposed pressure piping that is to convey liquid chemical shall be hydrostatically pressure tested.
- .2 Contractor must provide any additional piping support required for the additional testing loads if using liquid to pressure test air lines. Test duration for air piping is four hours.
- .3 Perform hydrostatic pressure and leakage testing of above ground piping as follows:
  - .1 All pressure testing shall be done in the presence of the Departmental Representative.

- .2 The duration of the test shall be 2 hrs .
- .3 Prior to hydrostatic testing or disinfection, all water retaining structures, pipework and conducts shall be thoroughly cleaned .
- .4 If required, safety relief valves shall be supplied with test gags for hydrostatic testing purposes. Upon completion of testing, the gags shall be removed and the system shall be repressed to the relieving pressure of the relief valves to ensure proper valve operation .
- .5 Test pressure shall be a 100kPag .
- .6 Maintain system pressure to within  $\pm 2.0$  kPa of test pressure throughout the duration of the test without the addition of make-up water .
- .7 Visually inspect all joints and flanges. There should be no visual evidence of leakage throughout the duration of test. Zero leakage is required.

**END OF SECTION**

## **1 GENERAL**

### **1.01** Description

- .1 The Work includes the provision of all necessary testing, calibration, and installation verification, for each component, equipment, instrumentation, etc. Once verification that all components, equipment instrumentation, etc. are functioning as intended, the Contractor shall commence with commissioning and start-up activities as specified herein .
- .2 Testing of the components, equipment, instrumentation and control equipment shall be coordinated with the testing of other equipment .
- .3 In cooperation with the Departmental Representative; perform extensive commissioning and start-up functions to verify the operation of all of the systems described herein as the installation is completed. Cooperation will be required to facilitate the timely performance of these activities and under the direction of the Departmental Representative. The Contractor will coordinate and schedule all activities associated with commissioning and start-up, and shall cooperate and arrange the commission schedule to facilitate the timely performance and completion of this work. The Contractor shall provide adequate notice to the Owner and Departmental Representative of any and all scheduled testing .
- .4 Provide a coordinated commissioning and start-up program. The overall program will be presented to the Departmental Representative for approval.

## **2 PRODUCTS**

- .1 Not applicable

## **3 EXECUTION**

### **3.01 Testing**

- .1 Prior to the completion of the Work, perform comprehensive testing of all installed equipment, components, instrumentation, etc.
- .2 Include the following activities:
  - .1 Pressure testing of components and piping .
  - .2 Flow and pressure validation of all liquid pumps including chemical dosing pumps .
  - .3 Performance testing of all equipment including but not limited to filters, mixers, storage equipment, etc .
  - .4 Test and calibrate all instrumentation to ensure proper functionality. Refer to Division 26 for further requirements .
  - .5 Demonstrate that all components, equipment and instrumentation are working as intended to ensure a fully functional water treatment system.
- .3 If required, provide the services of a manufacturer's representative for equipment to assist with any of the equipment tests to be performed. Any components, or systems found to be defective or deficient during the tests shall be repaired or replaced .
- .4 Coordinate test schedules with the Departmental Representative.
- .5 The participation in testing activities and the use of the equipment during testing periods by the Owner is to be allowed provided it does not adversely affect specified testing requirements. Such participation shall not relieve the Contractor of any of the obligations stipulated herein .
- .6 Prior to the commencement of any testing, the Contractor shall ensure that all spare parts, expendables, and test equipment pertinent to the system being tested are on site. Test equipment shall include all necessary pumps, gauges, meters, process instrument calibrators for 4-20 mA, 24 VDC devices and signal generators or simulators. Test equipment shall be

provided by the Contractor and shall remain the property of the Contractor at the end of all testing.

### **3.02 Calibration**

- .1 In situ, calibrate and adjust all components, equipment and instrumentation to verify correct operation, range adjustment, compensation, scaling, etc. Provide instrument calibration services for all individual components such as signal transmitters, analyzers, transducers, power supplies, and like equipment where appropriate .
- .2 Provide certified calibration reports for each component, equipment and instrument. In the reports, include, but do not limit to, such information as:
  - .1 Device tag number
  - .2 Equipment descriptions
  - .3 Service applications
  - .4 Flow and pressure validation (if applicable) .
  - .5 Process variable measurement range
  - .6 Description of calibration equipment used
  - .7 Date, name, and signature of technician
- .3 Include calibration reports in the operating and maintenance manuals.

### **3.03 Installation Verification**

- .1 When the system installation has been completed (or part thereof), perform detailed verification checks for all sub systems supplied and installed as part of the Work. In the checks and reviews, include the following:
  - .1 Certify that the equipment, components and instrumentation has been installed as per the Contract drawings and Manufacturer recommended installation procedures, reporting any discrepancies to the Departmental

Representative.

- .2 Certify that the equipment, components and instrumentation power and grounding requirements have been satisfied, reporting any discrepancies to the Departmental Representative.
- .3 Certify that the installation (or part thereof as completed) is ready for commissioning and start-up .
- .4 Witnessed Functional Acceptance Test shall be done on the complete control system .
- .2 Undertake any corrective action found to be necessary during the course of the verification checkout and review .
- .3 Report any discoveries of defects or deficiencies in writing to the Departmental Representative for any equipment supplied by the Owner.
- .4 Allow for the participation of the Owner's personnel in the verification checks. Such participation shall not relieve the Contractor of any of the obligations .
- .5 Prepare the various reports and certificates described herein. Forward three (3) copies of each report or certificate to the Departmental Representative. Clearly identify any discrepancies which require action on the part of the Departmental Representative.

### **3.04 Commissioning and Start-up**

- .1 Prior to commissioning and start-up activities, a series of operational tests will be performed by the Contractor, including, but not be limited to:
  - .1 Verification that all major equipment is installed and functioning as intended, including but not limited to pumps, valves, actuators, filters, instrumentation, etc .
  - .2 Perform testing of each subsystem. Upon confirmation that subsystems are functioning correctly perform testing of entire system .
  - .3 Complete any corrective action necessary that



has been identified as part of the checkout procedure, on an ongoing basis .

- .2 Conduct final verification of commissioning of all systems through actual operation of the various parts of the process as determined by the Owner and the Departmental Representative.
- .3 Coordinate work with supplier and Manufacturer representative and verify that their equipment and control systems are operating as part of the overall control system.
- .4 System commissioning will be considered complete when, in the opinion of the Departmental Representative, the entire system has properly operated for seven (7) continuous days, 24 hours per day without interruption. This 7-day period is in addition to any test periods or operational demonstrations specified elsewhere. The objective will have been achieved once it has been demonstrated that all systems are operating and have complied with the specified performance requirements herein.

**END OF SECTION**

# 1 GENERAL

## 1.01 DESCRIPTION

- .1 Section 43 21 39 refers to those portions of the Work that are unique to the supply and installation of a submersible style turbine well pumps (well pumps). This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.
- .2 The abbreviated standard specifications for testing, materials, fabrication and supply, referred to herein, are fully described in Quality Requirements - Section 01 40 00.
- .3 The well pump shall be installed in the underground potable water cistern. Details are described herein.

## 1.02 Scope of Supply

- .1 The Contractor shall install a 100m m diameter well casing for compatibility with the well pump, as per manufacturer's specifications. The work will include the supply and installation of the submersible well pump (with a backup pump supplied), connections to the cistern, above-ground sole plate, new discharge piping, valves, and components, etc. required to ensure a fully operational raw water well pumping system. The work will include upgrades to the Water Utility Shed, including the installation of a hydropneumatic tank, new control panel, all electrical work etc. as per manufacturer's specifications.
- .2 The well pump shall be a submersible style turbine well pump. The accepted pump shall be complete with flow sleeve, control unit and pressure transducer, 18L stainless steel holding tank.
- .3 The pump assembly shall include, but not limited to, the motor, intake screen, multistage turbine impeller assembly, discharge head, fittings, electrical cables,

motor lifting faculties, etc.

- .4 The Contractor shall be responsible for the provision of shop drawings and design information, supervision and verification of the equipment installation, arranging for a manufacture representative to take part in initial start up, validation testing information (including pressure and flow validation), on site testing, and operator training.
- .5 Pump performance information shall be submitted with the equipment proposal for evaluation by the Consultant. All pump performance information shall be in metric units and include Manufacturers pump head vs. flow (H-Q) curve, efficiency curves, pump speed ratings, best efficiency points (BEP's), pump input and shaft power curves, pump specific speed (Ns) ratings, suction specific speed (Nss) ratings, etc.

#### 1.03 Standards

- .1 American National Standards Institute (ANSI).
- .2 American Society for Testing and Materials (ASTM).
- .3 American Water Works Association (AWWA).
- .4 Canadian Standards Association (CSA).
- .5 Underwriters Laboratories of Canada (ULC).
- .6 Electrical and Electronic Manufactures Association of Canada (EEMAC).
- .7 National Electrical Manufactures Association (NEMA)
- .8 Canadian Electrical Code (CEC).

#### 1.04 Submittals

- .1 Shop drawings submittal period to be no longer than three weeks. Shop drawing submittal is part of the submittals prior to fabrication section.
- .2 Submittals Prior to Fabrication

- .1 Provide the type, Manufacturer, model, general description, specifications, data sheets, etc. for all major components.
- .2 Manufacturer shop drawings showing clearly all general and essential dimensions (including clearance requirements). Scaled drawings of pump, and motor. Provide drawings in both PDF and AutoCAD formats.
- .3 Detailed bill of materials for all components. Include Manufacturer's name, description, and catalogue number for each part. Provide a list of local parts suppliers for all equipment. Provide specifications related to sealing arrangements, impeller design, bearings, lubrication, etc.
- .4 Pump performance information be submitted and include the following information:
  - a. Manufacturers pump head vs. flow (H-Q) curve;
  - b. Pump efficiency curve including best efficiency point (BEP);
  - c. Rated pump and motor maximum speeds in revolutions per minute (RPM)
  - d. BEP at interim and ultimate duty points;
  - e. Pump speed turn down requirements for the interim and ultimate pump flow rates;
  - f. Maximum pump turn speed turndown in percentage of full RPM.
  - g. Pump input shaft power vs flow curve;
  - h. Motor output shaft power vs flow curves;

- i. Pump specific speed ( $N_s$ ) and suction specific speed ( $N_{ss}$ );
  - j. Net positive suction head required (NPSHr) vs. flow curves.
  - k. Provided typical full load amps (HA) for motor at 25% increments to full load at service factor. Provide typical starting current assuming motor to start under full voltage non reversing conditions (FVNR).
- .5 Minimum and maximum Manufacturer rated pump flow run-out and head operating limits for the pump.
  - .6 Electrical and control documentation for the proposed motor and recommended method of wiring. Electrical dimension drawings of the motor. Electrical/control schematic diagram showing all typical control and power systems for a VFD driven system.
  - .7 Provide a pump and motor Manufacturer's performance guarantee. The guarantee shall state that the pump and motor shall achieve the required design points for a minimum of two years.
  - .8 Certification that the pump and motor design life is rated for a minimum of 25 years, for continuous operation with regular maintenance. Identify all components which may need replacement during this period and state their normal life expectancy.
  - .9 Provide anticipated maintenance costs for the full design life of 25 years for the pump. The price shall be adjusted by using an escalation factor of +3.0% annually with the start of adjustment period commencing with the acceptance of equipment and commissioning.

- .10 Provide anticipated operational costs for the full design life of 25 years for the each pump. Assume continuous 12 hour operation per 24 hour period, at the above defined ultimate duty point. Assume a cost of \$09/kWh for utility electrical supply. The utility rate cost shall be adjusted using an annual escalation factor of +3.0%.
- .11 Provide the maximum radial thrust developed by the pump during startup. Provide thrust values based on full voltage non reversing or across the line start. (FVNR).
- .12 Provide motor operating powers for the required duty points. Ensure that power vs. flow curves provide operation power consumption for the intended pump operating points. Include starting amperage assuming FVNR.

### .3 Submittals Prior to Commissioning

- .1 Complete Operation and Maintenance (O&M) Manuals. The O&M manuals should be included for the pump, motor and VFD. The O&M manuals shall contain detailed startup, control and maintenance instructions, including a summary of components that require routine replacement.

## 1.05 Reference Sections:

- .1 Requirements covered in this section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein. Related sections include:
  - .1 Division 1 - General Requirements.

.2 Division 40 - Process Integration

1.06 Tools and Spare Parts

- .1 The Contractor shall provide a list of recommended spare parts, special tools, and maintenance materials. The costs of each recommended unit shall be provided with the submittal for the Owner to select.
- .2 Selected spare parts shall be suitably packaged with labels indicating the contents of the package.

1.07 Warranty and Guarantees

- .1 The Contractor shall be responsible for providing and honouring issues that fall within the manufacture equipment warranty and performance, as specified herein.
- .2 Manufacturer shall provide typical expected lifespan of the equipment with proper and regular maintenance.
- .3 Equipment Warranty:
  - .1 The Contractor shall provide Manufacturer warranty for the pumping equipment. Manufacture warranty shall be for a period of 24 months from period of commissioning. This includes all components associated with the pump, motor and control system.
  - .2 Providing the proposed equipment is installed in accordance with the instructions contained in the Manufacturer's Operation and Maintenance Manual, the Contractor shall replace or repair all components that fail or become defective within the 24 month period at no addition cost to the Owner.
  - .3 The Contractor shall be liable for the

direct labour and material cost of such repair or replacement issues that fall under the warranty.

## 2.0 PRODUCTS

### 2.01 General:

- .1 A single submersible well pump with backup pump and related parts shall be supplied and installed by the Contractor. Pump and motor specifications are summarized in Section 2.2 - 2.4.
- .2 The proposed submersible pump/motor assembly will be installed in the underground potable water cistern. The holding tank, control unit and pressure transducer, and related electrical system upgrades will be installed in the control building.
- .3 The pump shall be designed to provide continuous pressure and achieve the performance targets specific herein. The Manufacturer shall assume complete responsibility for conformance with these specifications.

### 2.02 Pump Performance:

- .1 The submersible well pump will be required to achieve the following duty points.
  - .1 Maximum Point: 1.2 L/sec at 7 m total dynamic header (TDH)
  - .2 Minimum Duty Point: 0.02 L/sec at 7 m TDH
  - .3 The above total dynamic head values use constant static head at 7m
- .2 Ensure the Manufacturers rated Pump Specific Speed (Ns) and Suction Specific Speed (Nss) for



the pump are clearly identified.

- .3 The Manufacturers rated pump efficiency for the maximum duty point shall be at a least 75%. The specified duty point shall fall no further than  $\pm 10\%$  away from the Manufacturers rated BEP. Ensure that the submitted pump performance curve clearly shows the recommended operating range.

#### 2.03 Pump Physical Requirements

- .1 The pump discharge shall be 25mm in diameter, threaded to NPT or flanged Class 300 ANSI B16.5.
- .2 Pump materials of construction must be suitable and approved for potable water applications. All machined pump elements shall consist of corrosion resistant stainless steel and be manufactured specifically for continuously submerged groundwater applications.
- .3 The proposed pump shall be installed in a 100mm diameter groundwater well casing.
- .4 Pump and thrust bearings shall be manufactured from a hard wearing material.
- .5 Bearings shall be manufacturer rated for 20 year lifespan with regular maintenance and lubrication. All bearings and races shall be replicable.

#### 2.04 Motor Requirements:

- .1 Pump manufacturer to provide submersible motor.
- .2 The submersible pump motor shall be rated for 230/115 volts, single phase power.
- .3 Motor efficiency shall be greater than 90% at full load.
- .4 The motor type shall be NEMA rated for submerged applications with corrosion resistant components. Motor shall be water filled for constant lubrication. Stator

shall be hermetically sealed to ensure moisture free windings. Motor system shall utilize a Kingsbury type thrust bearing to minimize excessive thrust.

- .5 The motor shall be rated and have operating characteristics suitable for driving the specified pumping equipment.
- .6 Each motor shall be CSA approved and carry a CSA inspection label.
- .7 The motor shall be sized to ensure that the rated service factor will not be exceeded. The rated FLA at full load shall not be exceeded during normal pumping operations.
- .8 Provide Manufacturers maintenance and operations manual. Provide a list of all motor components that will require replacement for the 25 year expected pump life.

### **3.0 EXECUTION**

#### **3.01 On Site Services:**

- .1 The Contractor shall provide a minimum of one (1) person-day and one (1) trip for on-site services by the Manufacturers representative including but not limited to:
  - .1 Provide assistance during installation and startup.
  - .2 Inspect, test, commission and adjust the equipment after installation to verify mechanical, structural and electrical integrity and conformance to the equipment specifications and Manufacturer's requirements.
  - .3 Pump flow and head check and confirm the equipment is operating at the required design point and within Manufacturer limits. Generate onsite head vs flow curves to be inserted into O&M manual.

- .4 Train operators on O&M tasks, including (but not limited to) pump removal, seal replacement, lubrication, and all other anticipated maintenance requirements.
  - .2 Provide additional services at no cost to the Owner to correct any operational problems due to the manufactures design and/or fabrication flaws.
  - .3 Submit name, qualifications, and experience of Field Technician. Owner may reject the proposed Field Technician based on insufficient experience.
- 3.02 Installation:
- .1 The pump is to installed in the cistern so that it can be removed and maintained while the cistern is full of water.
- 3.03 Commissioning and Testing:
- .1 Prior to startup, the Manufacturer representative shall inspect the pump, motor, pressure transducer and control for proper installation. If the installation is correct, the system may be started. The Manufacturer representative then shall inspect and ensure that the pumps, motors, controls are operating within Manufacturer limits.
  - .2 The Manufacturer's representative shall approve the installation and provide certification that the system components have been installed correctly and are ready for operation. Functional testing protocol shall be submitted to the Consultant three weeks prior to on-site testing.
  - .3 Functional testing shall be witnessed by the Consultant, and shall demonstrate that .the system and related control equipment operate in accordance with the Specifications, including all operating, monitoring, and shutdown functions. Functionality testing will include

verification that the pump meets the required duty points at full and reduced RPM and that the rated FLA is not exceeded during operations.

#### 3.04 Training:

- .1 The Contractor shall coordinate the Manufacture representative to provide a one (1) day on-site training session for the District operators. Coordinate training with the Consultant and the Owner's Representative.
- .2 The Manufacturer representative shall provide detailed daily, weekly, monthly and yearly maintenance and troubleshooting instructions during training.

END OF SECTION

## 1.0 GENERAL

### 1.01 Description

- .1 This section specifies general standards applicable to all process mechanical equipment in Divisions 33, 40, 43, 44, and 46 to be supplied as part of the Project.
- .2 All materials not specifically listed or specified, but required to complete the installation are the responsibility of the Contractor.
- .3 For instrumentation, control and electrical elements and devices, including control panels and their components, use this Section for conformance to style, quality, product, and mounting requirements .
- .4 Provide all supports, anchorage and mounting of all equipment in accordance with the manufacturer's recommendations, the National Building Code, Alberta Building Codes, seismic restraint requirements of Division 01, and industry standard requirements unless otherwise specified.
- .5 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.

### 1.02 Definitions

- .1 "Supplier's Representative" means a factory trained representative qualified to provide detailed installation instructions for equipment, inspect equipment installation, supervise equipment testing, and provide training on equipment maintenance and operation.

### 1.03 Reference Sections

Section 01 33 23	Shop Drawing, Project and Data Samples
Section 01 33 24	Submittals
Section 40 23 01	Water Process Piping, Valves and Fittings

### 1.04 Submittals for Review

- .1 Provide shop drawings as described below.

- .2 Process flow diagrams and process and instrumentation diagrams using ISA symbols for equipment which interfaces with the plant Programmable Logic Controller.
- .3 Assembly drawings showing dimensions, details of connections, anchorage and terminations of equipment for connection by others.
- .4 For pumps, blowers, compressors and fans, provide performance details and curves relating operating total dynamic head, and indicate operating point.
- .5 Provide list of materials of construction, detailing component parts and reference ASTM, ANSI, CSA etc. specifications.
- .6 Provide electrical single line diagrams.
- .7 Provide PLC and control panel details. Include detailed information and instructions regarding programmed functions.
- .8 Motor data including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances, and illustrative construction drawings. NEMA and CSA certifications, etc.
- .9 Gearbox and drive data including AGMA/AFBMA ratings for components, tolerances, and details and materials of construction.
- .10 Details of coating systems.
- .11 Details of methods of preventing galvanic corrosion between mating surfaces constructed of dissimilar metals.
- .12 Layout drawings showing location of ancillary devices, conduit, junction boxes, safety and control devices and conduit entries for feeding or controlling the equipment.
- .13 Instrument Loop Diagrams, Motor Control Schematics, Interconnecting Wiring Diagrams and Instrumentation and Control Schematics.

- .14 Instrument details.
- .15 Valve and valve actuator details.
- .16 Design loadings to be transmitted to foundations or supports, including size and location of anchor bolts or other attachments to foundations or supports.
- .17 Provide manufacturer technical assistance contact information

1.05 Submittals for Information Only

- .1 Provide submittals for information only as required by any item of equipment, and as specified below.
- .2 Installation instructions indicating assembly, mounting and anchorage requirements, alignment and assembly tolerances, and points of connection for ancillary services.
- .3 Start-up instructions including lubricant requirements, electrical requirements, etc.
- .4 Certification by a professional engineer registered in the Province of Alberta that anchor bolt calculations have been performed for all pieces of equipment indicating adequacy of bolt type, sizing and anchor embedment for all forces including seismic.
- .5 Completed forms as required by this Section for completion of installation, testing and commissioning.
- .6 Certificate of final inspection and approvals from the local electrical inspection authority.

1.06 Performance Guarantee

- .1 Each system supplier shall guarantee that the equipment supplied shall be capable of performing the functions described in the Specifications and in addition the specified guarantee and warranty in the relevant Section. Provide manufacturers guaranteed equipment lifespan.

1.07 Seismic Design

- .7 Design equipment and anchorage in accordance with the National Building Code.

#### 1.07 Equipment Identification

- .1 Provide metal nameplate on each piece of equipment, mechanically fastened, complete with recessed letters .
- .2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle phase and power of motors.
- .3 Indicate design conditions (ie: flow, outlet pressure) in metric units, RPM, and equipment identification number as shown on process and instrumentation drawings.
- .4 Provide equipment identification as per P&IDs.
- .5 Nameplate to be 304 stainless steel with 6 mm high indented and painted letters.

### 2.0 PRODUCTS

#### 2.01 Component Compatibility

- .1 Ensure all components of equipment systems including motor, drive, driven equipment and controls are compatible.
- .2 Provide equipment systems comprised of two or more components as a unit by the responsible manufacturer. Unless otherwise specified, the supplier of the driven unit is the responsible manufacturer.
- .3 Prevent isolation or choose materials to prevent electrolytic action between dissimilar metals and materials .
- .4 Choose and assemble all components of the equipment system to enhance compatibility, ease of construction, and efficient maintenance.

#### 2.02 Acceptable Manufacturers/Products

- .1 Each equipment specification lists a Design Standard upon which the design has been based, including dimensions, quality of workmanship, operating protocol, basic materials and ancillary services .



- .2 Where Acceptable Products or Acceptable Manufacturers have also been listed in an equipment specification, those products are considered as being capable of meeting the basic functional requirements of the equipment, but may not be the same as the Design Standard in detail.
- .3 Where "or approved equal" has been listed, acceptance is at the sole discretion of the Departmental Representative.
- .4 Provide all ancillary services, material upgrades etc. as necessary to satisfy quality requirements defined by the Design Standards .
- .5 Make all minor changes in arrangement, piping and/or electrical connections etc. as necessary to suit the requirements of the Acceptable Products or Acceptable Manufacturers .
- .6 No additional payment will be made for revisions or alterations made to accommodate the specific equipment approved and supplied.

## 2.03 Bearings

- .1 Provide equipment bearings with a minimum AFBMA L-10 rating life of 50,000 hours, as determined using the maximum equipment operating speed, unless otherwise specified.
- .2 Provide easily accessible grease supply, flush, drain and relief fittings for grease lubricated bearings, using extension tubes where necessary to extend inaccessible lubrication points and drains to convenient locations. Provide standard hydraulic type grease supply fittings.
- .3 Provide pressure lubricating or separate oil reservoir system for oil lubricated bearings. Provide a filler pipe and external level indicator gauge. System to be sized to absorb heat energy generated in the bearing at ambient temperature of 40 degrees C.
- .4 Provide ball or roller type equipment bearings unless otherwise specified, design to withstand the stresses of the service specified.

#### 2.04 V-Belt Assemblies

- .1 Belt to be selected for minimum 150 percent of rated drive power .
- .2 Provide anti-static type belts for explosion proof equipment
- .3 Statically balance sheaves and bushings. Where sheaves and bushings are to operate peripheral speeds greater than 1650 m/min. dynamically balance the assembly
- .4 Sheaves to have split, tapered, keyed hubs. Acceptable manufacturers: Dodge, Woods or approved equal.

#### 2.05 Guards

- .1 On all moving parts, and on exposed equipment with operating surface temperatures exceeding 40°C, provide sheet expanded guards in accordance with workplace safety regulations.
- .2 Provide expanded 14 gauge sheet removable guards, painted after fabrication to same standard as equipment, meeting OSHA requirements.
- .3 Guards to allow full movement of adjustable parts.

#### 2.06 Piping Connections

- .1 Provide piping connections compatible with piping systems to be connected. Refer and conform to quality standards in Specification Section 40 23 01

#### 2.07 Couplings

- .1 Provide flexible couplings for equipment with drives greater than 0.5 hp unless otherwise approved .
- .2 Couplings to accommodate angular and parallel misalignment and end float and to cushion shock loads and dampen torsional vibrations. No metal to metal contact.
- .3 Size each coupling as recommended by the coupling manufacturer and install in conformance with the

coupling manufacturer's instructions. Provide equivalent of shrunk-on fit.

- .4 Provide tire-type flexible member, attached to flanges by means of clamping rings and cap screws, with flanges attached to stub shaft by taperlock bushings.
- .5 Acceptable manufacturers: Dodge, Woods.

#### 2.08 Gauge Taps

- .1 Provide gauge taps on the suction and discharge side of pumps, blowers and compressors. Taps on air and clean water services to be 12 mm diameter. Complete with nipple, ball valve and cap.

#### 2.09 Housekeeping Pads

- .1 Mount equipment located on concrete slabs on a concrete housekeeping pad .
- .2 Pad to be a minimum of 150 mm higher than finished floor elevation and extend 150 mm outside the equipment base or 10 bolt diameters from the outer edge of the outermost anchor bolt, whichever is greater. Pad to drain away from the equipment base.
- .3 Conduit, drains, piping etc. required for ancillary connections to the equipment are to rise through the pad unless shown otherwise.

#### 2.10 Equipment Bases

- .1 Provide rectangular bases, structural steel shapes with sufficient rigidity to maintain equipment alignment and resist forces and moments from the piping system .
- .2 Bases to be designed to withstand the design earthquake condition.
- .3 Provide bases sized for the next size larger motor. Baseplate to extend beyond all extremities of the driver and driven equipment.

- .4 Provide grout holes in equipment bases. Grout equipment bases using non-shrink, pour grade, non-metallic grout.

#### 2.11 Anchor Bolts

- .1 Equipment supplier to provide anchor bolts, washers and nut sizing to general contractor for anchor bolts to be embedded in concrete for the equipment.
- .2 Equipment supplier to provide all connecting bolts, washers and nuts required for attaching pieces of equipment and materials to base-plates .
- .3 Anchor bolts in the dry areas to be cadmium plated or galvanized .
- .4 Anchor bolts in all other areas to be 304 stainless steel.
- .5 The Supplier shall co-operate with the General Contractor to provide details of the anchor bolts and shop drawings showing their installation details, length shape, and size, exact location and projection from the finished concrete are submitted to the General Contractor in ample time to allow ordering and delivery prior to their being required on site .
- .6 The Supplier shall be responsible for the design and material specifications of all anchor bolts, and shall indicate clearly on the shop drawings any bolts whose location tolerance is less than normal.
- .7 For rotating equipment, drilled expansion or adhesive anchors for anchor bolts shall not be allowed designed and approved by a Structural Engineer. Contractor to provide sealed shop drawings.
- .8 For rotating equipment provide anchor bolts with sleeves and washers to permit adjustment during installation of equipment.

#### 2.12 Stainless Steel Corrosion Control

- .1 Factory weld with 316L filler wire using inert gas welding process. Solar flux is not acceptable. Provide a cross section equal or greater than the parent metal.
- .2 Make all welds using the automatic orbital weld, gas

tungsten arc welding (GTAW) or TIG process with an internal inert gas purge to exclude oxygen in the weld root area. Welds shall be full penetration, free of cracks overlaps and cold laps. Maximum misalignment 1.6 mm or half the pipe wall thickness, whichever is less. Maximum weld reinforcement and concave root 1.6 mm. Maximum undercut 0.8 mm or 10% of base metal thickness, whichever is less. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion .

- .3 Clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:
  - .1 Pre-clean all outside weld areas to remove weld splatter with stainless steel brushes and/or stainless steel deburring and finish grinding wheels.
  - .2 Passivate and finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380.
- .4 Use anti-seize compound on all stainless steel bolt-ups.
- .5 Provide electrical isolation kits on all flanged connections where Stainless Steel pipe is connected is connected to a dissimilar metal, including valves and fittings.

#### 2.13 Jacking Screws

- .1 For base mounted rotating equipment larger than 10 hp, provide jacking screws for the driver and the driven end to facilitate alignment, consisting of 12 mm nuts welded to the frame of the equipment, and a 12 mm bolt fitting through the nut and extending to the mounting feet. Provide two jacking screws at each end of the equipment, one each parallel and perpendicular to the equipment axis.

#### 2.14 Vibration Loosening Prevention

- .1 Provide lock nuts or double nuts with lengthened bolts as suitable for the service to prevent loosening of bolt and nut assemblies if they are subject to vibration during equipment operation.

#### 2.15 CSA Approval

- .1 All instrumentation, control and electrical devices to be CSA approved and to bear the CSA approvals sticker.

#### 2.16 Pump Shaft Mechanical Seals

- .1 Provide single mechanical seals where specified for equipment.
- .2 Acceptable manufacturers: Flowserve (Durametalllic), John Crane
- .3 Provide non-destructive, cartridge type, self-aligning stationary seals, requiring no shaft wearing sleeve, flexible stator.
- .4 Drill and tap stuffing box for installation of seal water supply. Provide throat bushing to minimize sealwater flow.
- .5 Materials:
  - .1 Metal parts; 316 or 317L stainless steel
  - .2 Non-dog, single coil spring; 316 stainless steel or Hastelloy C
  - .3 a-rings; Viton
  - .4 Faces; Silicon carbide on tungsten carbide

#### 2.17 Spare Parts

- .1 Provide two year supply of manufacturer's recommended lubricants for all equipment.
- .2 For all belt driven equipment, provide two V-belt sets.
- .3 For shop applied coatings, provide 1 unopened litre each of primer and finish coat.
- .4 Tag and list spare parts in accordance with tag numbers on Contract Drawings.
- .5 Store spare parts as directed by the Owner's staff.

### 3.0 EXECUTION

#### 3.01 General

- .1 Ship and store equipment in accordance with Section 01 61 00 unless otherwise specified .
- .2 Provide all necessary special tools, materials, supplies, lubricants, measuring devices, shims, gaskets, ncidentals and other consumables as required to complete the installation and testing .
- .3 Provide for each piece of equipment a supplier's representative who shall instruct the General Contractor in the proper installation of the supplier's equipment and shall provide all necessary installation instructions to the General Contractor in writing .
- .4 Use anti-seize compound when securing equipment using stainless steel anchor bolts.

#### 3.02 Supplier Field Services

- .1 Provide the services of a supplier's representative to inspect the installation, and supervise the start-up, field testing and commissioning of each piece of equipment. Such times shall not necessarily be concurrent and shall be at the discretion of the Departmental Representative.
- .2 Without limiting the foregoing, the following are the minimum requirements to be completed to the satisfaction for the Departmental Representative:
  - .1 Attend a preliminary site meeting to instruct the General Contractor on the installation procedure.
  - .2 Provide an inspection service during the installation and check the final adjustments and alignment prior to start-up.
  - .3 Supervise testing and commissioning of the equipment.
  - .4 Instruct the Owner's plant operating personnel in the operation and maintenance of the equipment.
- .3 The Supplier's Representative may perform one or more of the foregoing requirements during one trip to the

site.

### 3.03 Preparation

- .1 Inspect and field measure prior to equipment installation to ensure that previous work is not prejudicial to the proper installation for equipment .
- .2 Make all submissions required by the Specifications and local authorities and pay all fees required for the equipment installation .
- .3 Make all minor modifications to suit piping and other installed equipment and structural element locations and elevations.

### 3.04 Installation

- .1 Install all equipment specified in other sections or shown in the drawings.
- .2 Dimensions shown in the Contract Documents for equipment bases, piping connections, control panel locations, etc. are approximate and must be allowed for in the installation of equipment to suit the actual equipment provided.  
Arrange at own expense any necessary modifications to accommodate the equipment provided .
- .3 Supply all necessary lifting and loading equipment and tools required to complete the installation.
- .4 Level equipment using 304 stainless steel shims.  
Levelling nuts are not allowed.
- .5 Grout equipment bases unless otherwise recommended by equipment manufacturer and agreed to by Departmental Representative. Fill the entire void underneath the base. Provide full contact with equipment base unless otherwise recommended by equipment manufacturer and agreed to by Departmental Representative. Neatly form and trim .
- .6 Remove storage lubricant and provide the initial fill of new lubricants for the equipment, grade as recommended by the equipment manufacturer.
- .7 Align rotating equipment in accordance with the more stringent requirements of either the equipment



manufacturer or the following:

- .1 Base to be level, using machinists level on all machined surfaces
- .2 Align couplings to +/-0.05 mm
- .3 Soft foot, maximum permissible 0.002 mm
- .4 Where equipment undergoes a temperature differential rise of 30 QC or greater, provide precision benchmarks in foundation and perform alignment at operating temperatures .
- .8 Near the end of the equipment installation period, the General Contractor shall notify the Supplier who shall send his representative to check over the installation when completed .
- .9 The Supplier's representative shall do a detailed check of the installation including, but not limited to, such items as: alignment, belt tension, bolt tension, running clearances, lubrication and workmanship .
- .10 The General Contractor shall promptly remedy the defects, if any, to the satisfaction of the Supplier's Representative and the Departmental Representative.
- .11 After the Supplier's Representative is satisfied that defects in installation have been remedied, alignment will be demonstrated to the Departmental Representative, following which the equipment shall be given a brief test run in the presence of the representative, the General Contractor and the Departmental Representative. Provide a minimum of 7 days notice to the Departmental Representative that alignment and a brief test run will be demonstrated.
- .12 The representative shall, when he is so satisfied, certify in writing that the installation is satisfactory and shall deliver the same to the Departmental Representative and the General Contractor before leaving the site.
- .13 Any defects in the installation as listed in Form 102 by the Supplier's representative shall be rectified by the General Contractor.

### 3.05 Equipment Testing

- .1 .1 Equipment Testing as described under this section

is in addition to the brief test run described in Section 3.03.

- .2 Equipment Testing is to be performed with water to demonstrate to the satisfaction of the Departmental Representative that:
  - .1 All system components are fully operational
  - .2 Control and instrumentation components have been calibrated and properly adjusted.
  - .3 All connecting piping is leak-proof and properly anchored
  - .4 The entire system is ready for continuous safe operation
- .3 The General Contractor shall notify the Supplier and the Departmental Representative 14 days ahead of the date when testing of the equipment furnished is to take place and the Supplier shall send his representative to the site to supervise and assist the General Contractor in the testing of the equipment. The site visit may be concurrent with the check for the satisfactory installation of the equipment, if mutually agreed upon by the Supplier and the General Contractor.
- .4 Before the Departmental Representative witnesses the testing, the Supplier's representative shall recheck the installation and advise the General Contractor as to any further installation, adjustments, checking, flushing or cleaning of the equipment required, and shall confirm that the equipment is ready to be operated.
- .5 The General Contractor and the Supplier's representative shall operate the equipment for at least one hour to demonstrate to themselves the satisfactory operation of the equipment and controls, and shall take any remedial steps necessary to ensure the satisfactory operation of the equipment.
- .6 Following such remedial action, the General Contractor shall notify the Departmental Representative that the equipment operation is ready to be demonstrated, and the Departmental Representative shall arrange to

promptly attend such demonstration together with the Owner's representative.

- .7 The General Contractor and the Supplier's representative shall then demonstrate to the Departmental Representative's satisfaction the equipment operation, and shall prove out the satisfactory operation of all controls over several cycles and in all operating modes. The General Contractor shall arrange to provide any supplies and water necessary to demonstrate the satisfactory operation of the equipment. Equipment shall be run continuously for a minimum of 24 hours as part of this demonstration .
- .8 Should the demonstration reveal any defects, then they shall be promptly rectified by the General Contractor and the demonstration of the equipment repeated to the satisfaction of the Departmental Representative. Should such repeat demonstration require a second, or subsequent, visit to the site by the Departmental Representative, the Owner's representative, the General Contractor, or the Supplier's representative, then the additional costs, if any, incurred by each party shall be paid for by the either the Supplier or the General Contractor, whichever is responsible for the defect and re-demonstration of the equipment operation .
- .9 During these tests valves, pumping rates, etc. shall be adjusted and made ready for raw water. Pressure, voltage, and amperage readings must be recorded. Each operating alarm condition must be simulated to ensure all controls and alarms are in good working order. The cost of any changes, adjustments or replacement of equipment that, in the opinion of the Departmental Representative, are due to defective materials or errors or omissions on the part of the Supplier shall be made good by the Supplier .
- .10 Once testing has been completed to the satisfaction of the Supplier's representative and the General Contractor, a Certificate of Satisfactory Testing Form shall be completed and presented to the Departmental Representative.
- .11 The Departmental Representative will sign the Certificate of Satisfactory Testing Form completed by the Supplier's representative when testing has been

completed to  
the satisfaction of the Departmental Representative.

### 3.06 Operator Training

- .1 After successful completion of Equipment Testing, provide the services of the Supplier's Representative to train representatives of the Owner in process control and proper operation and maintenance of the equipment.

### 3.07 Plant Commissioning

- .1 Plant commissioning cannot take place until reviewed and revised maintenance manuals have been received by the Departmental Representative and the Owner's representative's training as described under Section 3.7 has been completed .
- .2 Plant commissioning may take place once all systems have been successfully tested as described under 3.6 Equipment Testing, and the Supplier's representative and Departmental Representative have completed Satisfactory Completion of Testing forms for all equipment to be involved in commissioning .
- .3 The plant may be commissioned in steps, subject to the approval of the Departmental Representative. Prior to commissioning, the Contractor shall submit for approval by the Departmental Representative proposed commissioning procedures .
- .4 .4 Commissioning shall demonstrate to the satisfaction of the Contractor and the Departmental Representative that the equipment and materials furnished, with all auxiliary work, have been fully tested and have been in satisfactory operation for not less than 14 consecutive days.
- .5 The Owner may provide manpower for the Commissioning period if requested by the Contractor, but responsibility for supervision of that manpower and satisfactory operation of the equipment will remain with the Contractor.
- .6 Once commissioning has been completed to the

Bar U Ranch NHS	WATER TREATMENT EQUIPMENT	SECTION 46 00 00
VOC CISTERN	GENERAL REQUIREMENTS	PAGE 197
BU13-04-013		2013/05/01

satisfaction of the Supplier's representative and the Contractor, a Certificate of Satisfactory Commissioning shall be completed and presented to the Departmental Representative.

- .7 The Departmental Representative shall sign the Certificate of Satisfactory Commissioning Form when commissioning has been completed to the satisfaction of the Departmental Representative.

END OF SECTION

## 2.0 GENERAL

### 1.01 Description

- .1 Section 46 3000 refers to those portions of the Work that are unique to the design, supply, delivery, installation, start-up and commissioning of the chlorine metering pump feed system including all necessary accessories and related appurtenances located within the Bar U Ranch Water Cistern Process Building as necessary and as describe in the Design Report and as described herein. A single manufacturer of the chlorine metering pump shall be responsible for supplying all components of the metering pump feed system including the chlorine analyzer and chemical storage tanks. This Section must be referenced to and interpreted simultaneously with all other Sections pertinent to the Work described herein.

### 1.02 Related Work

- Section 40 23 01 Water Process Piping, Valves, and Fittings
- Section 40 24 00 Chemical Piping, Valves, and Fittings
- Section 46 00 00 Water Treatment Equipment General Requirements

### 1.03 Intent

- .1 Provide complete, fully tested and operational process systems to meet requirements described herein and in accordance with applicable codes and ordinances
- .2 Connect to equipment specified in other Sections

### 1.04 Submittals

- .1 Before fabrication, provide manufacturer data for each type of equipment, pipe material and for each fitting, valve, coupling, pump and related appurtenance used to complete the work covered in this section .

- .2 Provide Shop Drawings in accordance with Section 01 33 00.
- .3 Where specified or when directed by the Contract Administrator, provide mill test results or product samples .
- .4 Provide Project Record Documents including Equipment and Systems Manuals, Product Data, Materials and Finishes and Operation and Maintenance Data and Instructions in accordance with Section 01 33 00.

#### 1.05 Warranty and Guarantees

- .1 The Contractor shall be responsible for providing and honouring issues that fall within the manufacture equipment warranty and performance, as specified herein.
- .2 The Contractor shall provide Manufacturer warranty all equipment. Manufacture warranty shall be for a period of 24 months from period of commissioning.
- .3 Providing the proposed equipment is installed in accordance with the instructions contained in the Manufacturer's Operation and Maintenance Manual, the Contractor shall replace or repair all components that fail or become defective within the 24 month period at no addition cost to the Owner.
- .4 The Contractor shall be liable for the direct labour and material cost of such repair or replacement issues that fall under the warranty.

## 2.0 PRODUCTS

### 2.01 Description of System

- .1 Provide one packaged chemical metering pump feed system with back-up pump.
- .2 The chemical feed system shall include skid assembly containing chemical metering pumps, chlorine analyzer and associated equipment, all necessary piping, valves, fittings, supports, electrical controls and accessories. The chemical metering pump manufacturer

shall be responsible for supplying all components of the skid-mounted chemical metering pump feed package .

- .3 The packaged chemical feed pump system will be installed in conjunction with other components including chemical storage tanks, injection quills, and spill containment systems, to form a complete and workable chemical feed system. The vendor shall verify that each chemical feed system is compatible with all other components of the system, that all pipe sizes and materials are appropriate, and that all devices that are necessary for a properly functioning, trouble free system have been provided.

## 2.02 Design Conditions

- .4 The metering pump package will be designed for continuous metering of a specific chemical solution under the following conditions and requirements:

- .1 Chlorine Feed System

- .1 Capable of providing chlorine at a concentration between 0.1 - 1.0 mg/L of Cl (in the final distributed water) at water demand flows of 0 - 0.2 L/s. Capable of providing metering that is controlled by a chlorine analyzer, to maintain chlorine residuals in the concentration range provided above.

- .2 Chemical Feed Pumps & Injection Assembly

- .1 Chemical feed pumps, including 1 standby.
- .2 Complete with chemical tank flow switches for low level and off, as well as alarm relay.
- .3 Outlet tubing suitable for sodium hypochlorite solution.
- .4 Corporation stop or injection assembly for injection of solution into pipe. Capable of withstanding maximum back pressure of 150 psi.



.3 Chemical Storage Tank

- .1 Storage tank/systems shall be supplied. The storage tank shall be capable of storing one month's supply of chlorine, as recommended by the supplier.

.4 Sodium Hypochlorite

- .1 On start-up, Contractor shall provide one month's supply of chlorine for testing.

.5 Chemical containment

- .1 Containment pallets shall be supplied. Containment systems shall be capable of containing at least 1.5 times the volume of the storage tank.

2.03 Tagging

- .1 All components shall be provided with a corrosion resistant tags containing:
  - .1 Manufacturer
  - .2 Model
  - .3 P&ID tag number.

2.04 Injection Quills

- .1 Injection Quills shall be the retractable type, allowing the Quill assembly to be completely removed and serviced during system full operation with full gauge pressure in the main process piping.
- .2 Injection Quill assembly shall have a built-in check valve. Quill housing shall have a ball/corp stop style isolation valve manufactured from stainless steel.
- .3 Injection Quill body shall be manufactured from materials specific to each chemical application and conform to the compatibility information contained herein.
- .4 Unless otherwise specified, the quills shall utilize

12mm diameter connections. Injection quills shall be capable of dosing flow rates between 0 mL/min and 100 mL/min.

- .5 Injection Quills shall be rated for a maximum operating pressure of 1035kPag (150psig). Quill shall be connected to housing using a compression style connection. Safety chains manufactured from stainless steel shall also connect the Quill to the housing.
- .6 Injection Quill length shall be sized and manufacturer approved according to process pipe diameter (see Process Drawings) and installed as per manufacturers recommendations.
- .7 Injection Quills shall have NPT male threaded or flanged connections. Use Teflon tape on threaded connection prior to installation .

#### 2.05 Rotameters:

- .8 Rotameters shall be installed upstream of all analysis instruments including chlorine and turbidity analyzers.
- .9 Rotameter bodies to be fabricated from materials compatible with the fluid being conveyed .
- .10 Factory applied fluid flow scale shall be from 0 to 1000 ml/min or 0 to 50 liters/hour, Accuracy to be rated for 3% of full scale. Overall scale length shall be 100mm (4 inches) .
- .11 Unit should be rated for working pressures up to 1036kPa (150psi).

#### 2.06 Reagentless Free Chlorine Analyser/Controller

- .1 Each analyzer shall be wall panel mounted, complete with microprocessor, chlorine sensor, sensor holder, and flow sensor, pre-plumbed / valved and pre-wired.
- .2 Measurement range shall be 0.02 - 2.00 ppm free residual chlorine.
- .3 The analyzers shall not require chemical reagents.

- .4 The monitor shall provide: backlit LCD display; high and low alarm; 4-20 mA free chlorine output for recording and chlorine feed pump control; sample low flow indicator.
- .5 The CBR sensor shall work on amperometric principle, with membrane covered 2-electrode cell.
- .6 The CBR sensor and flow sensor shall be installed in in-line DGMA sensor holder module. Sample flow shall be 40-60 l/h, < 14.5 psi .
- .7 Loose supply a pressure reducing valve to 14.5 psi for the water sample.

### 3.0 EXECUTION

#### 3.01 Installation:

- .1 Install the components as per manufacturer's instructions and Contractors process drawings.
- .2 All equipment, including injection assembly shall be installed in accordance with the manufacturer's instructions.
- .3 Fill chemical tanks with appropriate solutions. Set chemical feed pump to deliver sufficient quantities .
- .4 Demonstrate simultaneous operation of chemical feed pump with well pump and filtration system.
- .5 If equipment fails to meet the any of the above requirements immediately make the necessary repairs, replacements, modifications and adjustments to ensure equipment functions as intended at no additional cost to Owner.

END OF SECTION

### 3.0 GENERAL

#### 1.01 Description

- .1 This Section 43 21 39 refers to those portions of the Work that are unique to the supply and installation of the cartridge filters; and all related appurtenances and; as necessary and as shown on the Contract Drawings and as described herein. This Section must be referenced to and interpreted simultaneously with all other Sections pertinent to the Work described herein.

#### 1.02 Related Work

Section 40 23 01 Water Process Piping, Valves, and Fittings

Section 40 80 00 Commissioning of Process System

Section 46 00 00 Water Treatment Equipment General Requirements

#### 1.03 Intent

- .1 Provide complete and fully tested and operational cartridge filters to meet requirements described herein and in accordance with applicable codes and ordinances.

#### 1.04 Submittals

- .1 Provide Shop Drawings in accordance with Section 01 33 00.
- .2 Provide Project Record Documents including Equipment and Systems Manuals, Product Data, Materials and Finishes and Operation and Maintenance Data and Instructions in accordance with Section 01 33 00.

### 2.0 Products

- .1 .1 Three (3) cartridge filters at the following microns, placed in series, in the order given below:

- 10 um
- 5 um
- 1 um

- .2 Cartridge Filter Housings shall be provided for each of the three filters. Each Cartridge Filter Housing shall be stainless steel, pressure rated for 150 psi, and have a removable cap with brass wing nuts for removal of filter cartridges.
- .3 All appurtenances and connections necessary for connecting the filters in series and for a bypass line as per manufacturers specifications.

### 3.0 Execution

#### 3.01 General

- .1 Installation of all three cartridge filters with associated housing as per manufacturer's specifications.
- .2 Contractor to install cartridge filters for compatibility with submersible well pump and chlorination system while maintaining system requirements.
- .3 Contractor to install bypass line.

#### 3.02 TESTING AND COMMISSIONING

- .1 Start Up Procedures
  - .1 Provide the draft operating and maintenance manuals and a detailed commissioning procedure to the Departmental Representative at least two (2) weeks in advance of start-up and commissioning .
  - .2 Start-up and commissioning of equipment to take place with commissioning of well pump and in the presence of a trained representative of the well pump supplier. Contractor to coordinate the on-site commissioning with the well pump supplier .
  - .3 Carefully check the set up and installation of filter cartridges to the satisfaction of the well pump supplier representative. Ensure of filters

are operating correctly .

- .4 Provide 48 hour notice to Departmental Representative of intent to commission the well.
- .5 Provide training of Bar U Ranch Staff in the safe operation of the cartridge filters.

END OF SECTION