

**Parks Canada**




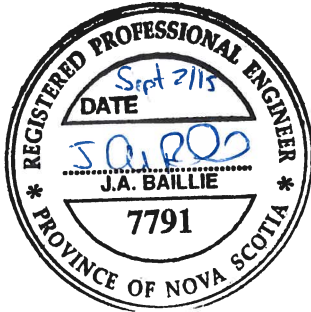
# **Broad Cove Campground Wastewater System**

**Issued for Tender**

**September 2015**

Contract: 142507.00

# **Broad Cove Campground Wastewater System**

Issued for Tender	JE	Sept 2/15	JAB
Issued for Review	SE	Aug 18/15	JAB
<i>Issue or Revision</i>	<i>Reviewed By:</i>	<i>Date</i>	<i>Issued By:</i>
 <b>CBCL LIMITED</b> Consulting Engineers  <b>ISO 9001</b> Registered Company			

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## PART 1 - GENERAL

### 1.1 WORK COVERED BY .1 CONTRACT DOCUMENTS

Work of this Contract takes place at the Broad Cove Campground near Ingonish in Cape Breton Highlands National Park in Nova Scotia. The Work involves but is not necessarily limited to the supply and installation of a new Recirculating Textile Filter (RTF) system, including septic tanks, recirculation tank, yard piping, UV disinfection system, monitoring equipment, connection to existing sanitary system, electrical wiring and controls, commissioning of installed equipment, operator training, operations maintenance, environmental protection and complete site reinstatement.

### 1.2 LIST OF .1 DRAWINGS

<u>Drawing No.</u>	<u>Drawing Title</u>
-	Cover Sheet
C01	Civil- Wastewater Treatment Facility Site Plan
C02	Civil - Wastewater Treatment Facility Miscellaneous Details
P01	Process-Wastewater Treatment Facility Plan
P02	Process-Wastewater Treatment Facility Sections
P03	Process-Wastewater Treatment Facility Sections and Details
E01	Electrical-Wastewater Treatment Facility Site Plan & Building Layout
E02	Electrical-Wastewater Treatment Facility Cabling Diagram & Details

1.3 CONTRACT METHOD .1 Construct Work under lump sum contract.

1.4 WORK SEQUENCE .1 Do construction Work in stages to accommodate continued use of premises during construction. Work requiring shutdown of system or excavation is not permitted on weekends.

1.4 WORK SEQUENCE  
(Cont'd)

- .2 Keep one (1) travel lane open to traffic at all times.
- .3 Commence work upon notice of award and complete all work including installation, testing prior to November 30, 2015.
- .4 Maintain Emergency Services access/control.
- .5 Short shutdown can be accommodated during camping season upon approval from Departmental Representative. Duration of shutdown could be between 4 and 8 hours depending on occupancy level of campground. Out of season, larger shutdown can be accommodated upon approval from Departmental Representative.

1.5 CONTRACTOR USE  
OF PREMISES

- .1 Follow all site standard operating procedures.
- .2 Obtain work permits before entering confined spaces.
- .3 Comply with all security requirements in place.
- .4 At completion of operations condition of existing work area to be: equal to or better than that which existed before new work started.

1.6 PROGRAM OF  
WORKS AND  
SCHEDULES

- .1 As soon as it is practicable, in any case not later than one (1) week after the Award, submit to the Departmental Representative for review and approval, a program and construction schedule showing the order of procedure, significant Contract dates, and method in which the Contractor proposes to carry out and complete the Works within time period required by Contract Documents.
- .2 Provide information regarding the implementation of the Works and of the Construction Equipment, temporary works, labour and construction crews which the Contractor intends to supply, use or construct as the case may be.
- .3 Construction Schedule to be standard "bar" type, showing commencement, duration and completion of activities of all trades and suppliers involved.
- .4 Construction Schedule is subject to review by Parks Canada and will be revised and resubmitted as directed.

1.6 PROGRAM OF  
WORKS AND  
SCHEDULES  
(Cont'd)

- .5 Update schedules periodically and submit updated Construction Schedule in duplicate with each request for payment. Where Work has fallen behind the original schedule times, indicate methods proposed to Completion Time.
- .6 Coordinate and schedule Work with other trades, including the Departmental Representative, such that the construction proceeds in a timely and efficient manner. Minimize disturbance to existing systems and provide access for the Departmental Representative to conduct routine maintenance and inspection.

1.7 EXISTING  
SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Department 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 vehicular traffic.
- .3 Provide alternative routes for vehicular traffic.
- .4 Establish location and extent of all service and utility lines in area of work before starting Work. Notify Department Representative of findings.
- .5 Where unknown services are encountered, immediately advise Department Representative and confirm findings in writing.

1.8 DOCUMENTS  
REQUIRED

- .1 Maintain at job site, one (1) copy each document as follows:
  - .1 Specifications.
  - .2 Drawings.
  - .3 Addenda.
  - .4 Change Orders.
  - .5 Other Modifications to Contract.
  - .6 Field Test Reports.
  - .7 Copy of Approved Work Schedule.
  - .8 Health and Safety Plan and Other Safety Related Documents.
  - .9 Other documents as specified.

1.9 STANDARD  
SPECIFICATIONS

- .1 Reference has been made to certain Domestic, National and International Standard Specifications throughout the various sections of the Specification contained herein. These Standard Specifications shall be considered an integral part hereof and shall be read in conjunction with the Drawings and Specifications as if they were reproduced herein. The Contractor must therefore be completely familiar with their contents and requirements. The latest editions of these Standard Specifications at the time of tendering will always govern.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

PART 1 - GENERAL

1.1 EXISTING  
SERVICES

- .1 Provide for vehicle, pedestrian, and other regular traffic for the duration of the construction.

1.2 USE OF THE  
WORKSITE

- .1 The Work Site will be specified by Parks Canada and will only be used for the purposes of the Work. The Work Site will be made available by Parks Canada to the Contractor for its non-exclusive use for the duration of the Work, unless otherwise provided in the Contract Documents. The Contractor's work or equipment must not exceed the contract boundaries.
- .2 Maintain adequate drainage at the Work Site.
- .3 Keep the Work Site clean and free from accumulation of waste materials and rubbish regardless of source.
- .4 Repair damage to the Work Site at no additional cost to the Contract.

1.3 UTILITIES

- .1 Shutdown of existing services is only permitted upon approval by Departmental Representative. Wastewater service interruptions of between 4-8 hours are acceptable upon submitting a detail plan, for approval, outlining activities to occur during the shutdown and an emergency plan in the event the service cannot be returned as scheduled.
- .2 Coordinate an on-site inspection with the utility company and Departmental Representative to locate any utility prior to starting work. Be responsible for work related to the protection or relocation of all utilities.
- .3 The locations of utilities, if any, shown or not shown are subject to verification by the Contractor.
- .4 Whenever working in the vicinity of utilities, locate such utilities and expose those that may be affected by the Work, using hand labour as required.
- .5 Immediately report any damage to utilities to the Departmental Representative and to the utility company or authority affected and promptly undertake such remedial measures as are necessary at no additional cost to the Contract.



1.4 SURVEY OF  
EXISTING PROPERTY  
CONDITIONS

- .1 Submission of tender is deemed to be confirmation that the Contractor has inspected the site and is conversant with all conditions affecting execution and completion of work.
- .2 Regularly monitor the condition of the Work Site and of property on and adjoining the Work Site throughout the construction period. Immediately notify the Departmental Representative if any deterioration in condition is detected. Such monitoring must cover all pertinent features and property including, but not limited to: buildings, structures, roads, walls, fences, slopes, sewers, culverts and landscaped areas.

1.5 PROTECTION OF  
PERSONS AND  
PROPERTY

- .1 Comply with all applicable safety regulations of the Workers' Compensation Board of Nova Scotia including, but not limited to: WCB's Industrial Health and Safety Regulations, Industrial First Aid Regulations, and Workplace Hazardous Materials Information System Regulations.
- .2 Take all necessary precautions and measures to prevent injury or damage to persons and property on or near the Work Site.
- .3 Promptly take such measures as are required to repair, replace or compensate for any loss or damage caused by the Contractor to any property or, if Departmental Representative so directs, shall promptly reimburse the Departmental Representative the costs resulting from such loss or damage.

1.6 USE OF PUBLIC  
AREAS

- .1 Do not allow vehicles and equipment to become a nuisance in public areas. Clean all vehicles and equipment leaving the Work Site and entering public roadways of mud and dirt clinging to the body and wheels of the vehicle. Load all vehicles arriving at or leaving the Work Site and transporting materials in a manner which will prevent dropping of materials or debris on the roadways, and where contents may otherwise be blown off during transit such loads shall be covered by tarpaulins or other suitable covers. Remove and clean spills of materials in public areas immediately at no additional cost to the Contract. Do activities in accordance with Section 01 35 43 - Environmental Procedures.

1.7 MEETINGS

- .1 The Work includes attending meetings between the Contractor and the Departmental Representative. The meetings will be called and chaired by the Contractor. The Contractor must be represented at such meetings.
- .2 The Departmental Representative will schedule an initial meeting to be held on site after award notification.
- .3 Cost of attending the above meetings will be considered incidental to the contract price proposal.

1.8 WASTE DISPOSAL

- .1 Remove all surplus, unsuitable and waste materials from the job site to appropriate sites outside of the Cape Breton Highlands National Park.
- .2 Dispose of any excess fill from the project outside of Parks Canada boundaries and in an approved disposal site at no additional cost to the Contract.
- .3 Deposit of any construction debris into any waterway is strictly forbidden.
- .4 Cost for Waste Disposal described above shall be considered incidental to the contract price; no additional payment will be made.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

PART 1 - GENERAL

1.1 RELATED  
SECTIONS

.1 Quality Control: Section 01 45 00

1.2 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.
- .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 coordinated 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 coordinated.
- .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.

1.2 ADMINISTRATIVE  
(Cont'd)

- .10 Keep one (1) reviewed copy of each submission on site.

1.3 SHOP DRAWINGS  
AND PRODUCT DATA

- .1 The term "Construction Drawing and Specifications" means drawings, diagrams, illustrations, schedules, detailed specification or descriptions of the Work as a part or a whole, statement or enumeration of particular of the Work as to size, quality, performance and terms and prepared by the Contractor.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow five (5) days for Departmental Representative's to review each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
- .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Specification section submittal covers.
  - .6 Other pertinent data.

1.3 SHOP DRAWINGS  
AND PRODUCT DATA  
(Cont'd)

- .8 After Departmental Representative's review, distribute copies.
- .9 Submit one (1) electronic and three (3) hard copies of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .10 Submit one (1) electronic and three (3) hard copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Submit one (1) electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accordance with specified requirements.
  - .2 Testing must have been within one (1) year of date of contract award for project.
- .12 Submit one (1) electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit one (1) electronic and three (3) hard copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit one (1) electronic and three (3) hard copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

1.3 SHOP DRAWINGS  
AND PRODUCT DATA  
(Cont'd)

- .15 Submit one (1) electronic copy and one (1) hard copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Delete information not applicable to project.
- .17 Supplement standard information to provide details applicable to project.
- .18 If upon review by Departmental Representative no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .19 The review of shop drawings by Departmental Representative is for the sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.4 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's Office, Cape Breton Highlands National Park, Ingonish Beach, NS, B0C 1L0.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

1.4 SAMPLES  
(Cont'd)

- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 PROGRESS  
PHOTOGRAPHS

- .1 On commencement of Work and at monthly intervals thereafter, supply the Departmental Representative with two (2) copies of (3) different view photographs to indicate progress of the Work. Take photographs from locations selected by Departmental Representative.
- .2 On the back side of each photograph legibly indicate project name, date and location of exposure.

1.6 CERTIFICATES  
AND TRANSCRIPTS

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

1.7 MAINTENANCE  
MANUAL AND  
OPERATING  
INSTRUCTIONS

- .1 Submit one (1) electronic and one (1) hard copies of completed volumes in final form of Maintenance Manual with application for Substantial Performance certificate. Maintenance Manual to consist of shop drawings and Project Data Book.
- .2 Include in Maintenance Manual one (1) copy of each final approved shop drawing issued for Project on which have been recorded changes made during fabrication and installation cause by unforeseen conditions.
- .3 Submit extended guarantees together in one (1) report binder.

1.7 MAINTENANCE  
MANUAL AND  
OPERATING  
INSTRUCTIONS  
(Cont'd)

- .4 The Manuals must:
- .1 Organize data in the form of an instructional manual in hard-covered, black, vinyl-covered binders of commercial quality, 8½" x 11" maximum ring size.
  - .2 Cover Identify each binder with typed or printed title "Project Record Documents"; list title of Project, identify subject matter of contents.
  - .3 Have a title sheet, or sheets, preceding data on which shall be a recorded Project name, Project number, date, list of contents, and Contractors and Subcontractors names.
  - .4 Be organized into applicable Sections of Work with each Section separated by hard paper dividers with plastic covered tabs marked by Section.
  - .5 Contain only typed or printed information and notes, and neatly drafted drawings.
  - .6 Contain maintenance and operating instructions on all building and mechanical and electrical equipment.
  - .7 Contain maintenance instructions as specified in various Sections.
  - .8 Contain brochures and parts lists on all equipment.
  - .9 Contain for each Product or System: List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
  - .10 Contain lists of supply sources for maintenance of all equipment in Project of which more detailed information is not included above.
  - .11 Contain finished hardware schedule.
  - .12 Contain mechanical and electrical charts, diagrams and reports specified in Contract Documents.
- .5 Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings in size of text pages.
- .6 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

1.8 LIST OF  
SUBCONTRACTORS

- .1 Provide the Departmental Representative the names of subcontractors for each project:
- .1 Within 20 days of award of subcontract or prior to the subcontractor doing any work, whichever occurs first.
  - .2 When the subcontractors work is valued at 10% or more of the construction cost for the project to which he is subcontracted.



1.8 LIST OF  
SUBCONTRACTORS  
(Cont'd)

- .1 (Cont'd)
  - .3 Submit a List of Subcontractors to the Departmental Representative stating:
    - .1 Indicate the names of all Subcontractors opposite the trades listed on a form.
- .2 Own forces may only be named in the form, when the Contractor is equipped to carry out by those named on the form. Substitutions of others must be approved by Departmental Representative.

1.9 CONSTRUCTION  
SCHEDULE

- .1 Submit proposed construction schedule at beginning of Project, as specified in Section 01 11 00.
- .2 As construction progresses, submit up-dated construction schedules each month to Departmental Representative, to Contractor's consultant and to each Subcontractor who is included on Schedule.

1.10 AS-BUILT  
INFORMATION

- .1 Record Drawings:
  - .1 After award of Contract, Departmental Representative will provide a set of drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Departmental Representative. Also record unidentified buried services encountered during the Work.
  - .2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Departmental Representative.
  - .3 On completion of Work and prior to final inspection, submit record documents to Departmental Representative.
- .2 Maintain as-built record drawings on site as the work progresses for all aspects of the work.
- .3 Departmental Representative will mark on "Project Record Copy" modifications made for work under the Scope of Work.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION                      Not applicable.

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 Nova Scotia
    - .1 Occupational Health and Safety Act, S.N.S. 1996.
- 1.2 SUBMITTALS
- .1 Make submittals in accordance with agreed upon practice.
  - .2 Submit site-specific Health and Safety Plan: Within seven (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 two (2) copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
  - .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 five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within three (3) days 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

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|--|-----|---|
| <u>1.2 SUBMITTALS<br/>(Cont'd)</u>     | .8  | (Cont'd)<br>overall responsibility for construction Health and Safety.  |
|  | .9  | Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative. |
|  | .10 | On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.   |
| <br>                                   |     |   |
| <u>1.3 FILING OF<br/>NOTICE</u>        | .1  | File Notice of Project with authorities prior to beginning of Work.   |
| <br>                                   |     |   |
| <u>1.4 SAFETY<br/>ASSESSMENT</u>       | .1  | Perform site specific safety hazard assessment related to project.  |
| <br>                                   |     |   |
| <u>1.5 MEETINGS</u>                    | .1  | Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.   |
| <br>                                   |     |   |
| <u>1.6 REGULATORY<br/>REQUIREMENTS</u> | .1  | Do Work in accordance with all existing regulatory requirements in place at the Site.   |
| <br>                                   |     |   |
| <u>1.7 GENERAL<br/>REQUIREMENTS</u>    | .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.  |
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- 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 Workers Compensation Act.
- .2 Comply with Occupational Health and Safety Act, Occupational Safety General Regulations, NS Reg.
- .3 Comply with Provincial Building Code Act.
- .4 Comply with National Building Code 2010, Part 8.
- .5 Comply with National Fire Code of Canada.
- .6 Comply with Dangerous Goods Transportation Act.
- 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 Nova Scotia 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 Coordinator. Health and Safety Coordinator 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.
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<u>1.11 HEALTH AND SAFETY CO-ORDINATOR (Cont'd)</u>	.1	(Cont'd) .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.
<u>1.12 POSTING OF DOCUMENTS</u>	.1	Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Nova Scotia having jurisdiction, and in consultation with Departmental Representative.
<u>1.13 CORRECTION OF NON-COMPLIANCE</u>	.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.
<u>1.14 BLASTING</u>	.1	Blasting or other use of explosives is not permitted.
<u>1.15 WORK STOPPAGE</u>	.1	Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
<u>PART 2 - PRODUCTS</u>		Not applicable.
<u>PART 3 - EXECUTION</u>		Not applicable.

PART 1 - GENERAL

1.1 RELATED  
SECTIONS

- .1 Health and Safety: Section 01 35 29.

1.2 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.

1.3 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 Environmental Protection Plan to include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction task(s).
- .5 Include in Environmental Protection Plan:  
.1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan.  
.2 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,

1.3 ACTION AND  
INFORMATIONAL  
SUBMITTALS  
(Cont'd)

- .5 (Cont'd)
- .2 (Cont'd)
- Federal, Provincial, and Municipal laws and regulations.
- .3 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non- use. Include in plan measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .4 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .5 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .6 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .7 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.
- .8 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.
- .9 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
- .10 Include pesticide treatment plan and update as required.

1.4 FIRES

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

1.5 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



- 
- |   |  |
|---|--|
| <u>1.5 DRAINAGE<br/>(Cont'd)</u>                      | <ul style="list-style-type: none"><li>.1 (Cont'd)<br/>control plan, Federal, Provincial, and Municipal laws and regulations.</li><li>.2 Provide temporary drainage and pumping required to keep excavations and site free from water.</li><li>.3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.</li><li>.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.</li></ul>  |
| <br>  |  |
| <u>1.6 SITE CLEARING<br/>AND PLANT<br/>PROTECTION</u> | <ul style="list-style-type: none"><li>.1 Protect trees and plants on site and adjacent properties as indicated.</li><li>.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 2m minimum.</li><li>.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.</li><li>.4 Minimize stripping of topsoil and vegetation.</li><li>.5 Restrict tree removal to areas indicated or designated by Departmental Representative.</li></ul> |
| <br>  |  |
| <u>1.7 WORK ADJACENT<br/>TO WATERWAYS</u>             | <ul style="list-style-type: none"><li>.1 Operate construction equipment on land only.</li><li>.2 Do not use waterway beds for borrow material.</li><li>.3 Waterways to be free of excavated fill, waste material and debris.</li><li>.4 Design and construct temporary crossings to minimize erosion to waterways.</li><li>.5 Do not skid logs or construction materials across waterways.</li><li>.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.</li></ul>  |
-

1.8 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.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.9 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.

1.10 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

Not applicable.

PART 3 - EXECUTION

3.1 CLEANING

- .1 Clean site to conditions equal to or better than prior to construction.
- .2 All rubbish and waste materials to be disposed of offsite at Contractors expense.
- .3 Keep public waterways, storm and sanitary sewers free of waste and volatile materials disposal.

PART 1 - GENERAL

- |                             |    |  |
|-----------------------------|----|--|
| <u>1.1 SECTION INCLUDES</u> | .1 | Inspection and testing, administrative and enforcement requirements.   |
|                             | .2 | Equipment and system adjust and balance.   |
|                             |    |  |
| <u>1.2 PRECEDENCE</u>       | .1 | For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.   |
|                             |    |  |
| <u>1.3 INSPECTION</u>       | .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 may order any 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, the Departmental Representative shall pay cost of examination and replacement. |
|                             |    |  |
| <u>1.4 ACCESS TO WORK</u>   | .1 | Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.   |
|                             | .2 | Co-operate to provide reasonable facilities for such access.   |

1.5 TESTING

- .1 The Contractor is responsible to pay for the services of a testing laboratory for:
  - .1 Inspection and testing required by laws, ordinances, rules and regulations.
  - .2 Tests specified to be performed by Contractor.
  - .3 Inspection and testing performed exclusively for convenience of Contractor.
- .2 Provide such assistance, labour and materials as are normally required for examining, measuring and testing the quality, weight or quantity and pay all costs of any material used for testing as may be selected and as specified.
- .3 Perform or arrange for the performance of all tests on all equipment in complete accordance with the relevant clauses of these Specifications and in the presence of the Departmental Representative.
- .4 The cost of providing assistance for testing and of performing or arranging tests shall be deemed to be covered by and included in the Contract Price unless noted otherwise, elsewhere in these Specifications.
- .5 The Contractor has no claim against the Departmental Representative in respect of any financial loss which may be suffered from the rejection of any materials or equipment due to their failure to meet specified test requirements, and also bear the cost of remedying any defects such that the material or equipment will meet the specified tests, or failing this, of removing the material or equipment from the Site. The decision to repair or replace materials and equipment which have failed to meet test requirements will be made by the Departmental Representative.

1.6 PROCEDURES

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

1.7 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.

- 
- 1.7 REJECTED WORK      .3      If in opinion of Departmental Representative it is  
(Cont'd)
- 1.8 REPORTS      .1      Submit four (4) copies of inspection and test  
reports to Departmental Representative.
- .2      Provide copies to Subcontractor of work being  
inspected or tested and the manufacturer or  
fabricator of material being inspected or tested.
- .3      Provide interim geotechnical compaction test data as  
requested by the Departmental Representative.
- 1.9 MATERIALS AND      .1      Equipment, materials and workmanship must be the  
WORKMANSHIP                              best of the respective kinds described in the  
Contract and in accordance with the Departmental  
Representative's instructions and will be subjected  
to such standard tests as the Departmental  
Representative may direct at the place of manufacture  
or fabrication or on the Site.
- .2      Before ordering materials for incorporation into the  
Works, inform the Departmental Representative of the  
source of the materials, except as regards to minor  
matters, no order for such materials will be given  
except with the authorization of the Departmental  
Representative. Notwithstanding the fact that such  
authorization may have been given, the Departmental  
Representative may forbid the use of any such  
materials, if upon delivery, they are found to be  
defective or unsuitable for incorporation in the  
Works. Keep the Departmental Representative fully  
advised of the orders and delivery dates of  
materials.
- .3      All material and equipment required to be  
incorporated into the Work must be new and unused.  
Any material found during the progress of the Work to  
have cracks, flaws, or other defects will be rejected  
by the Departmental Representative and replaced at no  
additional cost to the Contract.
- .4      Replace materials and equipment found defective in  
manufacturer or damaged in handling after delivery by
-

1.9 MATERIALS AND .4  
WORKMANSHIP  
(Cont'd)

(Cont'd)  
the manufacturer. This includes the furnishing of all materials and labour required for the replacement of installed material and equipment discovered defective prior to the final acceptance of the Work.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

PART 1 - GENERAL

1.1 SECTION  
INCLUDES

- .1 As-built drawings, samples and specifications.
- .2 Product data, materials and finishes, and related information.
- .3 Spare parts, special tools and maintenance materials.
- .4 Warranties.
- .5 Attached forms.
- .6 Operations and Maintenance Manuals start-up reports.

1.2 RELATED  
SECTIONS

- .1 Quality Control: Section 01 45 00

1.3 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .5 If requested, furnish evidence as to type, source and quality of products provided.
- .6 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .7 Pay costs of transportation.
- .8 Include equipment data collection and decommissioning forms in manual.



1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
  - .1 Date of submission; names,
  - .2 Addresses, and telephone numbers of Departmental Representative with name of responsible parties;
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

1.6 RECORDING  
ACTUAL SITE  
CONDITIONS

- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, field test records, required by individual specifications sections.

1.7 FINAL SURVEY

- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.
- .2 Provide detailed as-built survey in AutoCAD format showing three (3) metre grid elevations the site.

1.8 MATERIALS AND  
FINISHES

- .1 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .2 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Additional Requirements: as specified in individual specifications sections.

1.9 MAINTENANCE  
MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 WARRANTIES

- .1 Provide warranty letter that states all materials and workmanship is warranted for one (1) year from date of Substantial Completion.
- .2 Separate each warranty with index tab sheets.
- .3 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .4 Obtain warranties, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.
- .5 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

1.10 WARRANTIES (Cont'd) .6 Verify that documents are in proper form, contain full information, and are notarized.

.7 Co-execute submittals when required.

.8 Retain warranties until time specified for submittal.

PART 2 - PRODUCTS Not applicable.

PART 3 - EXECUTION Not applicable.

PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Procedures for demonstration and instruction of equipment and systems to the facility personnel.
<u>1.2 RELATED SECTIONS</u>	.1	Closeout Submittals: Section 01 78 00
	.2	Commissioning: Section 01 91 13
<u>1.3 DESCRIPTION</u>	.1	Demonstrate operation and maintenance of equipment and systems to facility personnel.
	.2	Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
<u>1.4 QUALITY CONTROL</u>	.1	When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct facility personnel, and provide written report that demonstration and instructions have been completed.
<u>1.5 SUBMITTALS</u>	.1	Submit schedule of time and date for demonstration of each item of equipment.
	.2	Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
	.3	Give time and date of each demonstration, with list of persons present.
<u>1.6 CONDITIONS FOR DEMONSTRATIONS</u>	.1	Equipment has been inspected and put into operation in accordance with this Section.
	.2	Testing, adjusting, and balancing has been performed.
	.3	Provide copies of completed operation and maintenance for use in demonstrations and instructions.

- 
- 1.7 PREPARATION .1 Verify conditions for demonstration and instructions comply with requirements.
- .2 Verify designated personnel are present.
- 1.8 DEMONSTRATION AND INSTRUCTIONS .1 Demonstrate operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manual as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manual when the need for additional data becomes apparent during instructions.
- PART 2 - PRODUCTS Not applicable.
- PART 3 - EXECUTION Not applicable.

PART 1 - GENERAL

- |                              |    |   |
|------------------------------|----|---|
| <u>1.1 SECTION INCLUDES</u>  | .1 | Includes general requirements for commissioning wastewater treatment system.  |
|                              |    |   |
| <u>1.2 RELATED SECTIONS</u>  | .1 | Quality Control: Section 01 45 00   |
|                              |    |   |
| <u>1.3 QUALITY ASSURANCE</u> | .1 | Testing organization services under provisions specified in Section 01 45 00.   |
|                              | .2 | Commissioning technician to be trained and certified by equipment manufacturer. Provide proof of training and certification of commissioning personnel.   |
|                              | .3 | Comply with applicable procedures and standards of the certification sponsoring association.  |
|                              | .4 | Perform services under direction of supervisor qualified under certification requirements of sponsoring association.  |
|                              |    |   |
| <u>1.4 SUBMITTALS</u>        | .1 | Prior to start of Work, submit name of organization or Contractor personnel proposed to perform services. Designate who has managerial responsibilities for coordination of commissioning activities. |
|                              | .2 | Submit documentation to confirm organization and personnel compliance with quality assurance provision.   |
|                              | .3 | Fifteen days prior to Substantial Performance, submit three (3) copies of final reports on applicable forms.  |
|                              | .4 | Submit testing reports postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.                                      |
-

1.5 PROCEDURES -  
GENERAL

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify Departmental Representative three (3) days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report to Departmental Representative any deficiencies or defects noted during performance of services.

1.6 FINAL REPORTS

- .1 Organization having managerial responsibility shall make reports.
- .2 Confirm each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.7 CONTRACTOR  
RESPONSIBILITIES

- .1 Prepare each system for testing.
- .2 Cooperate with testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing and adjusting.
- .4 Notify testing organization seven (7) days prior to time project will be ready for testing.

1.8 PREPARATION

- .1 Provide instruments required for testing and adjusting operations.
- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify equipment is in full operation.



- 1.9 EXECUTION
- .1 Test pumps, instruments and controls, and adjust devices for systems.
  - .2 Acceptance testing by manufacturer or approved service technician.

PART 2 - PRODUCTS Not applicable.

PART 3 - EXECUTION Not applicable.

- 
- 1.1 GENERAL .1 This section covers items common to Division 26.  
This section supplements requirements of Division 01.
- .2 Refer to Electrical Drawings and scope of work  
outlined herein, for demolition and removals to be  
carried out.
- 1.2 RELATED WORK .1 Direct Buried Underground Conduits: Section  
33 65 76
- 1.3 REFERENCES .1 CSA-C22.1-15, Canadian Electrical Code, Part 1.
- .2 CAN/CSA C22.2 No. 0.1-M1985(R2013), General  
Requirements for Double-Insulated Equipment.
- .3 CSA-C22.3 No. 7-2015, Underground Systems.
- .4 CAN3-C235-83(R2015), Preferred Voltage Levels for AC  
Systems, 0 to 50 000 V.
- .5 EEMAC Y1-2-1979, Standard for Performance  
Specification for Finishing Systems for Outdoor  
Electrical Equipment.
- .6 EEMAC 2 Y-1-1958, Standard for EEMA Light Gray  
Colour for Indoor Switchgear.
- 1.4 SCOPE OF WORK .1 The work to be done under this contract consists of  
furnishing all materials, tools, equipment and  
labour, and performing the electrical services as  
indicated and as specified herein and on the  
Electrical Drawings.
- .2 Remove, salvage and dispose of existing electrical  
and controls equipment as noted on the drawings.
- .3 Supply and install one (1) new 120/240V, 100A, 1  
phase, 3W, 30 circuit panelboard complete with  
circuit breakers in the existing comfort station  
building.
- .4 Supply and install new electrical underground  
ductbanks as indicated on the drawings.
- .5 Install and interwire electrical/instrumentation for  
mechanical and process systems specified in other  
divisions including the supply and installation of  
power, control & instrumentation cabling and required
-

1.4 SCOPE OF WORK  
(Cont'd)

- .5 (Cont'd)  
conduit and mounting hardware, in accordance with these specifications and shop drawings/manufacturer requirements.
- .6 Supply and install new termination junction boxes, including all necessary fittings and mounting hardware, as indicated on the drawings.
- .7 Supply and install new conduit, including all necessary fittings, couplings, cable glands, conduit seals, and mounting hardware, as indicated on the drawings.
- .8 Supply and install power distribution, general services, control, instrumentation and communications wiring and cables.
- .9 Document, test and calibrate to satisfaction of the Departmental Representative, electrical equipment as specified herein and on the drawings.
- .10 Safely store electrical equipment awaiting installation.
- .11 Protect installed electrical equipment during construction.
- .12 Repair/replace equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, at no expense to the Contract. These expenses include all material, labour and other fees.
- .13 Obtain "scope of work" clarification prior to issuing their Tender. Any cost extras due to any misunderstanding/ misinterpretation of the scope of work will not be entertained during the construction phase of the work.
- .14 Coordinate/schedule with other trades to ensure that the construction proceeds in a timely and efficient manner. Minimize disturbance to existing systems and provide access for plant operator for routine maintenance and inspection.
- .15 Refer to Section 01 14 00 for construction restrictions and additional information regarding electrical work affecting restrictions at the existing plant operation.
- .16 As indicated on the drawings, some areas within the treatment plant facility are Zone 1 and Zone 2 hazardous locations as defined by Section 18 of the

1.4 SCOPE OF WORK  
(Cont'd)

- .16 (Cont'd)  
Canadian Electrical Code. All electrical installations in these areas shall be completed in accordance with the Canadian Electrical Code for the specified classification. These areas may contain hydrogen sulphide (North American Gas Group C, IEC Gas Group IIB) and methane (North American Gas Group D, IEC Gas Group IIA) gases. These areas are also a Category 2 location in accordance with Section 22 of the Canadian Electrical Code and the electrical installation shall be completed as per the requirements of a Category 2 location. Refer to the electrical design drawings for locations of hazardous locations.
- .17 Refer to individual sections for additional scope of work items.

1.5 CODES AND  
STANDARDS

- .1 Do complete installation in accordance with CSA C22.1 and local regulations except where specified otherwise.
- .2 Do underground systems in accordance with CSA C22.3 No. 7, except where specified otherwise.
- .3 Comply with all CSA electrical bulletins in force at the time of tender submission. While not identified or specified by reference number in this division, the bulletins shall be considered to form part of the related CSA part II standard.
- .4 Abbreviations for electrical terms: to CSA Z85.

1.6 CARE,  
OPERATION AND  
START-UP

- .1 Instruct operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

- 
- 1.7 VOLTAGE RATINGS .1 Operating voltages: to CAN3-C235.
- .2 Motors, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- 1.8 PERMITS, FEES AND INSPECTION .1 Submit to the Electrical Inspection Department, Municipal Authority and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Submit this information within twenty (20) working days of the award of Tender and provide the Departmental Representative with written notice at the time this has been submitted.
- .2 Provide the Departmental Representative with a copy of the Electrical Inspection Department and Supply Authority Plans Review Report immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.
- .3 Obtain all necessary permits including an Electrical Wiring Permit for electrical work and Communications Cabling Permit for communications cabling work from the authority having jurisdiction prior to commencement of work. Provide a copy of each permit to the Departmental Representative upon receipt. Properly display the permits on the work site.
- .4 Upon specific request, the Departmental Representative will provide to the Contractor, up to a maximum of three (3) copies of the drawings and specifications required for submittal to the Electrical Inspection Department and Supply Authority. These drawings and specifications will be provided to the Contractor at no cost, unless specified otherwise.
- .5 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Departmental Representative immediately upon receipt. Notify the Departmental Representative immediately of changes required by the authority having jurisdiction prior to making changes. All changes must be approved by the Departmental Representative.
-

1.8 PERMITS, FEES  
AND INSPECTION  
(Cont'd)

- .6 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of Work. Include a copy in the Operations and Maintenance Manual.
- .7 Pay all associated fees.

1.9 MATERIALS AND  
EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 45 00.
- .2 Equipment and material to be CSA certified or certified by an agency approved by the Electrical Inspection Department. Where there is no alternative to supplying equipment which is not certified, obtain special approval from Electrical Inspection Department and the Departmental Representative.
- .3 Factory assemble control panels and component assemblies.

1.10 ELECTRIC  
MOTOR, EQUIPMENT  
AND CONTROLS

- .1 Coordinate supplier and installer responsibility for mechanical and process equipment specified in other specification divisions to ensure complete and functioning systems.
- .2 Confirm location of process equipment and associated control devices specified in other divisions. All device locations may not be necessarily shown on the electrical drawings.

1.11 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.
  - .1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
  - .2 Paint outdoor electrical equipment green finish to EEMAC Y1-1.
- .2 Clean and touch up surfaces of existing and new shop-painted equipment scratched or marred during shipment or installation, to match original paint to the satisfaction of the Departmental Representative. If not acceptable, replace equipment at no additional cost to the contract.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.12 FASTENERS AND  
EQUIPMENT MOUNTING

- .1 Fastening devices for all equipment and components, including bolts, nuts, washers, and screws shall be stainless steel or galvanized steel throughout. Use only stainless steel in hazardous locations.
- .2 In the Comfort Station Building wall mount electrical equipment on 21mm thick fire retardant plywood backboards that are fastened directly to the wall. Paint plywood with two (2) coats of fire retardant paint to match wall colour.

1.13 EQUIPMENT  
IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as specified herein.
- .2 Identification:
  - .1 Supply and install lamicaid nameplates on all panels, disconnect switches, receptacles, control panels, magnetic starters, TOL's, etc. as further described herein. Take care to affix all plates true and level, and plumb in all instances.
  - .2 Affix nameplates to surfaces with contact type cement.
  - .3 Affix nameplates to building "exterior" surfaces with nylon inserts and self tapping screws unless specifically indicated otherwise.
  - .4 Apply contact type cement (buttered) to complete rear side of plate, as opposed to several locations or areas on same.
  - .5 Lamicaid nameplates installed on distribution panelboards must indicate the following:
    - .1 Designated name of equipment.
    - .2 Voltage, amperage number of phases and wires.
    - .3 Designation of power source.  
PANEL C  
120/208V, 100A, 3PH, 4W  
FED FROM PANEL B
  - .6 Lamicaid nameplates installed on combination starters, magnetic starters, manual starter and all various systems controls, control panels, disconnect switches, etc., to contain the following information:
    - .1 Designated name of equipment or equipment being fed, whichever is applicable.
    - .2 Designated name of power source.
    - .3 Branch circuit breaker number(s) where possible.

1.13 EQUIPMENT  
IDENTIFICATION  
(Cont'd)

- .2 Identification:(Cont'd)  
.6 (Cont'd)  
.4 Voltage(s) and phase.

(Cont'd)

FAN NO. 5  
PANEL H - CKT. 17  
120V - 1 PH

SUPPLY FAN NO. 3  
M.C.C. NO. 1  
600V - 3 PH

.7 Lamicoid nameplates installed on fusible type disconnect switches are to also indicate the maximum designated/designed fuse size.

.8 Install lamicoid nameplates on all junction and pull boxes sized 150 mm x 150 mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.

.9 Install lamicoid nameplates above all types of receptacles and abutted directly to tops of their respective device plates. Identification is to indicate respective panel source complete with associated circuit breaker number(s). Lamicoid plate to be 1.5 mm thick x 13 mm high complete with 6 mm black letters on white core, directly above all flush receptacles. Plate to be identical width as finish device plate and the top left and right corners to be rounded off.

.10 Lamicoid nameplates above 120V receptacles protected by GFCI circuit breakers, or GFCI type receptacles are to be identified as per the following:

.1 1.5mm thick x 19mm wide complete with 6 mm black letters on white core above all receptacles. Identical width as finish device plate (EXAMPLE: GFCI Protected Panel H-26).

.11 Allow for an "average" of 40 letters for each lamicoid nameplate.

.12 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, for all electrical systems.

.13 Lettering on lamicoid nameplates shall not "start", nor "end" nearer than 9 mm from either, or both ends of said plates.

.14 Size of lettering, including overall lengths of various plates must be as indicated in the following chart.



1.13 EQUIPMENT  
IDENTIFICATION  
(Cont'd)

.2 Identification:(Cont'd)  
.14 (Cont'd)

NOMINAL NAMEPLATE SIZES

Size 1	10mm x	50mm	1 line	5mm high letters
Size 2	13mm x	75mm	1 line	6mm high letters
Size 3	16mm x	75mm	2 lines	5mm high letters
Size 4	19mm x	90mm	1 line	10mm high letters
Size 5	50mm x	90mm	2 lines	13mm high letters
Size 6	25mm x	100mm	1 line	13mm high letters
Size 7	25mm x	100mm	2 lines	6mm high letters
Size 8	50mm x	150mm	2 lines	13mm high letters
Size 9	50mm x	100mm	3 lines	10mm high letters

- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Identification to be English.
- .5 Provide lamicoid nameplates and install on, or adjacent to, all various systems' control panels and/or cabinets complete with information as indicated. Nameplates are to reflect individual system's assigned name, and where applicable, also indicate both designated panel name and associated branch circuit breaker number(s).
- .6 Co-ordinate names of equipment and systems with other trades to ensure that equipment identification is consistent.
- .7 Interior junction boxes to have the panel and circuit numbers of all wiring contained within listed on the coverplate. Neatly write list using black indelible marker.
- .8 Provide clearly visible marking on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.
- .9 Provide terminal boxes, panels and miscellaneous equipment fed from two or more sources with a warning nameplate prominently displayed: "CAUTION - MORE THAN ONE SOURCE VOLTAGE".
- .10 Provide terminal boxes, panels and miscellaneous wire ways containing intrinsically safe circuits with a warning nameplate prominently displayed: "INTRINSICALLY SAFE CIRCUIT".

1.14 WIRING  
IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Panduit PLD-1 and PLD-2 or approved equivalent.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Indicate panel and circuit number on all phase conductors (i.e., Panel A, ckt 3) at the device and at any intermediate junction/pull boxes.
- .6 Identify all neutral conductors to indicate the phase conductor with which they are associated and at any intermediate junction/pull boxes.

1.15 CONDUIT AND  
CABLE  
IDENTIFICATION

- .1 Colour code conduits, boxes and cables to match existing systems.
- .2 Colour code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours to match existing systems.
- .4 For power cables to electrical equipment, indicate designated name of equipment and designated name of power source (i.e., Fuel Pump #1 - fed from MCC #1).
- .5 Where more than one (1) cable terminates at a device, add cable number (i.e., -1, -2) to end of cable identification.
- .6 Use Electrovert PVC K-marking sleeves (black on yellow), complete with PVC carrier strip and self-locking nylon cable ties (black) or approved equivalent.

1.16 WIRING  
TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

- 
- 1.17 MANUFACTURERS AND CSA LABELS .1 Visible and legible after equipment is installed.
- 1.18 WARNING SIGNS .1 As specified and to meet requirements of Electrical Inspection Department.
- .2 Decal or Porcelain enamel signs, minimum size 180 mm x 250 mm.
- 1.19 LOCATION OF EQUIPMENT .1 Locate outlets in accordance with the Drawings and these Specifications.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of equipment at no extra cost or credit, providing distance does not exceed 1 m and information is given before installation.
- 1.20 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 Wall receptacles:
- .1 General: 450 mm (18").
- .2 Elevated mounting in process areas: 1200 mm (48").
- .3 Outdoors: 1200 mm (48") above finished grade.
- .2 Panelboards: as required by Code or as indicated.
- 1.21 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 Submit, at completion of work, a report listing phase and neutral currents on panelboards, operating
-

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- 1.21 LOAD BALANCE .2 (Cont'd)  
(Cont'd) under normal load. State hour and date on which each load was measured, and voltage at time of test.
- 1.22 CONDUIT AND .1 Install conduit and sleeves prior to pouring of  
CABLE INSTALLATION concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Arrange and pay for holes through exterior walls; provide flashings and make weatherproof.
- .4 Install conduits to be embedded or plastered over, neatly and close to the building structure so furring can be kept to a minimum.
- 1.23 FIELD QUALITY .1 Conduct and pay for following tests:  
CONTROL
- .1 Power distribution system including phase rotation, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Insulation resistance testing:
- .1 Megger circuits, feeders and distribution equipment up to 350 V with a 500 V instrument.
- .2 Megger 350-600 V circuits, feeders and distribution equipment with a 1000 V instrument.
- .3 Check resistance to ground before energizing.
- .4 Provide a type written tabular report indicating test results.
- .4 Provide a type written tabular report indicating the normal field measured load current for all motors, indicating the motor circuit protector trip setting or fuse type/rating, the overload heater element sizes and/or settings. Indicate the motor nameplate current.
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- 1.23 FIELD QUALITY CONTROL  
(Cont'd)
- .5 Advise Departmental Representative of dates when testing will take place. Provide five (5) days notice of such tests.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for Departmental Representative's review and approval.
- 1.24 SHORT-CIRCUIT & PROTECTION COORDINATION STUDY
- .1 Install circuit protective devices such as overcurrent trips, relays and fuses to required values and settings.
- 1.25 QUALITY ASSURANCE
- .1 Instructions:
- .1 Interferences: electrical drawings are generally of a diagrammatic nature. Plan and coordinate the work to eliminate interferences with other trades. Provide all necessary raceway offsets, fittings, and boxes, adjust all fixture and equipment boxes, adjust all fixture and equipment locations and provide all supporting materials required for a planned, coordinated and neat installation. Where interferences occur, the Departmental Representative's authorized representative will decide which item must be relocated regardless of which was installed first.
- .2 Electrical workmanship: provide workmanship of the highest quality. Sub-standard work will not be accepted. Use only persons skilled in the trades involved.
- .3 Electrical materials: provide all materials used in this work, unless particularly specified otherwise, that are new, free from flaws, or imperfections.
- .4 Sleeves and inserts: furnish and locate all sleeves and inserts required for this work in accordance with drawings.
- .2 Applicable standards:
- .1 All electrical work must conform with the requirements and recommendations of the latest edition of the Canadian Electrical Code and all local codes and ordinances. In conflicts between codes, the more stringent requirements shall govern.
- .2 In no instance will the standard established by this specification be reduced by any of the codes or standards referred to in this specification.
-

1.25 QUALITY  
ASSURANCE  
(Cont'd)

- .2 Applicable standards:(Cont'd)
  - .3 Standards: the specifications and standards of the following organizations are by reference made as part of these specifications and all electrical work, unless otherwise indicated, shall comply with their requirements and recommendations wherever applicable.
  - .4 Canadian Standard Association (CSA).
  - .5 Institute of Electrical and Electronics Engineers (I.E.E.E.).
  - .6 Instrument Society of America (I.S.A.).
  - .7 American Society for Testing Materials (A.S.T.M.).
  - .8 Insulated Power Cable Consultants Association (I.P.C.E.A.).
  - .9 National Electrical Manufacturer's Association (NEMA).
  - .10 National Fire Protection Association (N.F.P.A.).
  - .11 Underwriter's Laboratories of Canada (U.L.C.).
  - .12 Joint Industrial Council (J.I.C.).

1.26 PROCESS  
EQUIPMENT PACKAGES

- .1 Coordinate electrical work with the process system vendors.
- .2 Verify connection details and requirements for interwiring between vendor supplied process equipment packages specified in other divisions.
- .3 Refer to manufacturer's shop drawings for connection details and recommended installation details.
- .4 Provide all cable, conduit, supports and miscellaneous hardware as per the requirements of this specification.

1.27 RECORD  
DRAWINGS

- .1 Record Drawings:
  - .1 After award of Contract, Departmental Representative will provide a set of full-sized drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Departmental Representative.
  - .2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Departmental Representative
  - .3 On completion of Work and prior to final inspection, submit record documents to Departmental Representative.
  - .4 Refer to Section 01 78 00 for more details.

1.28 WASTE  
MANAGEMENT AND  
DISPOSAL

---

- .1 Remove from site and dispose of all debris and waste materials at appropriate disposal/recycling facilities.
- .2 Separate and recycle waste materials in accordance with applicable Construction/Demolition Waste Management And Disposal Regulations.

## PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA C22.2, No. 65-13, Standard for Wire Connectors.

## PART 2 - PRODUCTS

- 2.1 WIRE AND BOX CONNECTORS .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.
- .2 Tin-plated copper, colour keyed, crimp type compression connectors, (long barrel, two hole) with a straight, 45° or 90° lug tongue configuration as required.
- .3 Clamps or connectors for armoured cable, liquid tight, flexible conduit, as required.
- .4 All wire connectors must be rated for operating voltage indicated.

## PART 3 - EXECUTION

- 3.1 WIRE AND BOX CONNECTORS INSTALLATION .1 Make all connections and terminations electrically and mechanically secure. Sizes of connectors to be as per manufacturer's recommendations for various sizes and combinations of wire sizes.
- .2 Make all joints required in branch wiring #8 and smaller utilizing "twist-on" pressure type connectors.
- .3 Make branch wiring joints larger than #8 AWG utilizing colour keyed crimp type compression connectors (two hole, long barrel, tin-plated copper) complete with manufacturer approved compression tools. Apply a first layer of compound type tape followed by additional layers of vinyl electrical tape. Bolt compression connectors together and torqued in accordance with manufacturer's recommendation. Heat shrink can also be used.
- .4 Plier tighten marrette type connectors.
- .5 Make wire connectors for connections to equipment not provided with lugs utilizing colour keyed, crimp



3.1 WIRE AND BOX	.5	(Cont'd)
CONNECTORS		type compression connectors (long barrel, two hole,
INSTALLATION		tin-plated copper, straight lug tongue) complete with
(Cont'd)		manufacturer approved compression tools. Alternate
		lug tongue configurations (45° and 90°) will be
		accepted where required by application.

## PART 1 - GENERAL

- |                             |    |   |
|-----------------------------|----|---|
| <u>1.1 SUBMITTALS</u>       | .1 | Submit shop drawings, and product data in accordance with Section 01 33 00. |
| <u>1.2 RELATED SECTIONS</u> | .1 | Conduits, Conduit Fastenings and Conduit Fittings: Section 26 05 34         |
|                             | .2 | Wire and Box Connectors (0 - 1000V): Section 26 05 20                       |
|                             | .3 | Primary Process Instrumentation Devices and Cabling: Section 26 90 00       |
| <u>1.3 REFERENCES</u>       | .1 | CSA C22.1-15, Canadian Electrical Code.                                     |

## PART 2 - PRODUCTS

- |  |    |  |
|--|----|--|
| <u>2.1 BUILDING WIRES</u>                              | .1 | Conductors: soft drawn, stranded, copper(of 98% conductivity). Minimum size #12 AWG.   |
|  | .2 | Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90-XLPE.   |
|  | .3 | Copper conductors: size as indicated, with 1000V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90-XLPE. |
|  | .4 | Colour code wiring in accordance with the Canadian electrical Code.  |
| <u>2.2 PROCESS CONTROL AND INSTRUMENTATION CABLING</u> | .1 | Refer to Section 26 90 00 and electrical drawings.   |
-

PART 3 - EXECUTION

3.1 INSTALLATION  
OF BUILDING WIRES

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34.
- .2 Twist together stranded conductors at each termination.

3.2 INSTALLATION  
OF CABLES: GENERAL

- .1 Support cables independently of supports used for equipment of other trades; do not support from or secure cables to ductwork and piping.
- .2 Install cables in a neat and professional manner, so as to conserve headroom.
- .3 Install cables parallel and perpendicular to building lines.
- .4 In wet/damp areas and outdoors, cables to enter into the bottom of the equipment.
- .5 Twist together stranded conductors at each termination.
- .6 Ty-rap branch circuit phase conductors and neutral (where applicable) at the closest point of entry within all panelboards, pullboxes, junction boxes, motor control centres and switchboards.

PART 1 - GENERAL

1.1 RELATED WORK .1 Electrical General Requirements: Section 26 05 00

1.2 REFERENCES .1 CSA C22.2 No. 41-2013, Grounding and Bonding Equipment.  
.2 CSA C22.1-15, Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

2.1 EQUIPMENT .1 Clamps for grounding of conductor, size as required and suitable for application.  
.2 Direct buried grounding conductors: bare stranded copper of 98% conductivity, soft annealed, size as indicated.  
.3 Insulated grounding and bonding conductors: soft drawn, stranded copper of 98% conductivity, type RW90 (green coloured insulation) in all conduits. Conductors to be FT4 rated when installed in free air.  
.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:  
.1 Grounding and bonding bushings.  
.2 Protective type clamps.  
.3 Bolted type conductor connectors.  
.4 Thermit welded type conductor connectors.  
.5 Bonding jumpers, straps.  
.6 Pressure wire connectors.  
.7 Copper, crimp type compression connectors.

---

PART 3 - EXECUTION

3.1 INSTALLATION  
GENERAL

- .1 Install complete permanent, continuous, grounding systems including conductors, connectors, accessories, as indicated to conform to requirements of Departmental Representative, and local authority having jurisdiction over installation.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections and connections to electrodes using exothermic welding process or inspectable copper crimp type compression connectors.
- .5 Use mechanical connectors for grounding connections to equipment provided with grounding lugs.
- .6 Use copper, crimp type compression connectors for grounding connections to equipment not provided with connectors.
- .7 Soldered joints not permitted.
- .8 Make grounding connections in radial configurations only, with connections terminating at single grounding point. Avoid loop connections.
- .9 Install insulated copper bonding conductor in all conduit runs. Minimum size #14 AWG or as indicated in Table No. 16 of the CEC, whichever is larger.
- .10 The 'feed' bonding conductor shall be secured (wrapped around unbroken) to the grounding screw of each outlet/device box, before connecting to the other grounding conductors and/or providing a "pig-tail" lead for device terminations.
- .11 Twist together all ground/bond wires with a screw-on type wire connector, and then place in the rear of the outlet box.

3.2 SYSTEM AND  
CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary systems.

3.3 EQUIPMENT  
GROUNDING & BONDING

- .1 Install grounding and bonding connections to typical equipment included in, but not necessarily limited to following list: Service equipment, frames of motors, motor starters, control panels, distribution panels, process equipment, instrumentation, and process piping.

3.4 FIELD QUALITY  
CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform tests before energizing electrical system.

PART 1 - GENERAL

1.1 NOT APPLICABLE .1 Not applicable.

PART 2 - PRODUCT

- 2.1 SUPPORT CHANNELS
- .1 U shape, size 41 mm x 41 mm, 2.7 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings unless otherwise indicated.
  - .2 Standard rolled structural steel shapes and plates or prefabricated structural systems.
  - .3 Unless otherwise indicated, use hot dipped galvanized steel (after fabrication) or stainless steel.
  - .4 Use stainless steel outside and in electrically hazardous areas.
- 2.2 CABLE TIES
- .1 Nylon flame retardent, low smoke cable tie, size as required.
  - .2 Nylon flame retardant, low smoke cable tie mounting bracket. Use mechanical fastening type only; adhesive mounts not acceptable.
  - .3 The use of cable ties for supporting purposes is not permitted. Cable ties can only be used to hold various system cables in place.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
  - .2 Secure equipment to poured concrete with expandable inserts.
  - .3 Secure equipment to hollow masonry walls with stainless steel toggle bolts.

3.1 INSTALLATION  
(Cont'd)

- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole straps for conduits and cables larger than 50 mm.
  - .3 Conduit straps to match conduits in material and finish. Cable straps to be galvanized steel or stainless steel.
  - .4 Use heavy duty cable/conduit clamps (with adjustable saddles) to secure conduits/cables to support channels.
- .6 Suspended support systems for horizontal runs.
  - .1 Support individual cable and conduit runs with minimum 9 mm dia. continuously threaded rods and spring clips.
  - .2 Support two (2) or more cables and conduits on channels supported by minimum 12 mm dia threaded rod hangers where direct fastening to building construction is impractical.
  - .3 Continuously threaded rods shall be zinc plated steel or stainless steel to match supporting hardware.
  - .4 Install strut in attic space above roof truss to secure threaded rod. Strut is to span a minimum of two (2) trusses. Secure strut to truss with wood screws.
- .7 For surface mounting of two or more conduits and cable, use support channels spaced in accordance with the Canadian Electrical Code (maximum 1.5m spacing).
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Provide adequate support for conduits and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure conduits or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.



3.1 INSTALLATION  
(Cont'd)

- .12 Provide fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Provide hot dipped galvanized or stainless steel beam clamps to secure conduits to exposed steel work.
- .14 Various suspended types of junction, pull and/or outlet boxes as well as conduits, are to be supported with minimum size 9 mm threaded rod, nuts and flat washers. Secure threaded rods to boxes with one flat washer and nut installed on both sides of box.
  - .1 One (1) rod required for all type boxes sized 150 mm x 150 mm and smaller.
  - .2 Two (2) rods required for boxes sized 200 mm x 200 mm and larger, up to and including those sized 300 mm x 300 mm.
  - .3 Minimum of four (4) rods required for all boxes sized larger than 300 mm x 300 mm.
  - .4 Cut-off all excess rod within 12 mm of channel bottom.
- .15 In addition to C.E.C. minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one additional support rod installed not greater than 300 mm and mid point of "all" 90° bends. Maximum spacings between conduit support channels will be as dictated by smallest size conduit(s) being supported and/or secured to same.
- .16 Where galvanized steel supports are exposed to moisture, touch-up all field cut surfaces with galvanizing paint.
- .17 Provide isolation pads between dis-similar metals where required.
- .18 Coordinate the location of electrical support systems with other trades before installation.

PART 1 - GENERAL

- 1.1 SUBMITTALS .1 Submit shop drawings, and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

- 2.1 JUNCTION AND PULL BOXES .1 General: Provide outlet, tap, junction, pull and floor boxes with screw-fastened covers. Provide junction and pull boxes longer than 300mm in any dimension complete with continuously hinged cover.
- .2 Tap, Junction and Pull Boxes: Provide boxes constructed of welded and galvanized sheet steel, of sizes required by Canadian Electrical Code. Use 14 USS gauge metal on boxes with no dimension of 600 mm (24") or more, except use 10-gauge boxes with any dimension of 900 mm (36") or more.
- .3 Provide NEMA Type 4 or 4X water-tight boxes with clamped, threaded or bolted covers. Boxes shall be painted steel, stainless steel (316SS) or copper free cast aluminum boxes. PVC boxes may be used in areas where rigid PVC conduit is installed.
- .4 Hazardous Rated Boxes:  
.1 Boxes must be suitable for the hazardous classification as noted on the drawings.  
.2 Boxes must be cast ferrous metal or stainless steel boxes with threaded connection for use with threaded galvanized steel conduit.  
.3 Boxes must be copper free cast aluminum boxes with threaded connections for use with threaded aluminum conduit.
-

PART 3 - EXECUTION

3.1 CABINETS,  
JUNCTION AND PULL  
BOXES

- .1 Only main junction and pull boxes are indicated on the drawings. Provide boxes to suit field conditions and where required by the Canadian Electrical Code.
- .2 Install junction and pull boxes in inconspicuous but accessible locations.
- .3 Mount cabinets with top not higher than 2m above finished floor.
- .4 Provide all required mounting hardware.
- .5 Junction boxes larger than 150mm x 150mm used in branch circuit wiring are to be complete with bonding terminal stripes.
- .6 Bond all pull boxes with bonding conductor.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.

PART 1 - GENERAL

1.1 NOT APPLICABLE .1 Not applicable

PART 2 - PRODUCTS

- 2.1 OUTLET AND CONDUIT BOXES .1 General:
- .1 Size boxes in accordance with CSA C22.1.
  - .2 100 mm square or larger outlet boxes as required for special devices.
  - .3 Gang boxes where wiring devices are grouped.
  - .4 Blank cover plates for boxes without wiring devices.
  - .5 Combination boxes with barriers where outlets for more than one system are grouped.
- .2 Sheet steel outlet boxes:
- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 x 50 x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side.
  - .2 100 mm square or octagonal outlet boxes for lighting fixture outlets.
  - .3 Electro-galvanized steel utility boxes for outlets connected to surface mounted EMT, minimum size 100mm x 54mm x 47mm.
- .3 Masonry boxes: electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.
- .4 Concrete boxes: electro-galvanized steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.
- .5 Surface mounted outlet boxes:
- .1 Cast FS or FD copper free aluminum or feralloy boxes (to match conduit material) with factory threaded hubs and mounting feet for surface wiring of switches, receptacles, thermostats, etc.
  - .2 NEMA 4X PVC outlet boxes in areas where PVC conduit is to be used.
- .6 Explosion proof outlet boxes:
- .1 Surface mounted, single gang, cast aluminum or feralloy outlet box with factory threaded hubs, rated for installation in the hazardous area classification as noted on the drawings.

2.1 OUTLET AND  
CONDUIT BOXES  
(Cont'd)

- .6 Explosion proof outlet boxes:(Cont'd)
  - .2 Confirm the outlet box and device are compatible and that the required hazardous rating is maintained.

2.2 FITTINGS -  
GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Use double locknuts and insulated bushings on sheet metal boxes. Use watertight bushings and cable connectors for all cable/conduit terminations in process control cabinets and NEMA 3R/4/4X pull/junction boxes.

PART 3 - EXECUTION

3.1 OUTLET BOX,  
AND CONDUIT BOX  
INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.
- .3 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers not allowed.
- .4 Recess outlet boxes in finished areas.

## PART 1 - GENERAL

- |                                |    |  |
|--------------------------------|----|--|
| <u>1.1 LOCATION OF CONDUIT</u> | .1 | Drawings do not show all conduits. Those shown are in diagrammatic form only.                |
| <u>1.2 RELATED WORK</u>        | .1 | Section 26 05 29 - Fastenings and Supports.  |
|                                | .2 | Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.                                 |
| <u>1.3 REFERENCES</u>          | .1 | CAN/CSA-C22.2 No. 18.1-13, Outlet Boxes, Conduit Boxes and Fittings and Associated Hardware. |
|                                | .2 | CSA-C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.                            |
|                                | .3 | CSA C22.2 No. 45.1-2007 (R2012), Electrical Rigid Metal Conduit - Steel.                     |
|                                | .4 | CSA C22.2 No. 45.2-2008 (R2013), Electrical Rigid Metal Conduit - Aluminium.                 |
|                                | .5 | CSA C22.2 No. 56-2013, Flexible Metal Conduit and and Liquid Tight Flexible Metal Conduit.   |

## PART 2 - PRODUCTS

- |                     |    |  |
|---------------------|----|--|
| <u>2.1 CONDUITS</u> | .1 | Rigid galvanized steel threaded conduit, fittings and connectors: to CSA C22.2 No. 45.1. |
|                     | .2 | Rigid aluminum threaded conduit, fittings and connectors: to CSA C22.2 No. 45.2.         |
|                     | .3 | Rigid PVC conduit, fittings and connectors: to CSA C22.2 No. 211.2.                      |
|                     | .4 | Flexible aluminum conduit and liquid-tight flexible metal conduit: to CSA C22.2 No. 56.  |
|                     | .5 | Minimum power and control/instrumentation conduit size for all areas: 21mm.              |
|                     | .6 | Rigid PVC conduit to be FT4 rated.   |

2.1 CONDUITS (Cont'd)	.7	Utilize UV resistant rigid PVC conduit when installed outdoors.
2.2 CONDUIT FASTENINGS	.1	One hole conduit straps to secure surface conduits 50 mm and smaller. Two hole conduit straps for conduits larger than 50 mm.
	.2	Heavy duty pipe clamps (with adjustable saddle) to secure conduits to support channels.
	.3	Refer to specification Section 26 05 29 for suspended and surface support systems for conduits.
	.4	Finish and material for conduit fastenings to match conduit.
	.5	Provide isolators between dis-similar metals as required.
2.3 CONDUIT FITTINGS	.1	Fittings: manufactured for use with conduit specified. Coating: same as conduit.
	.2	Factory "ells" where 90° bends are required for 25 mm and larger conduits.
	.3	Cast type EYS and EYD type sealing fittings with factory threaded hubs and rated for installation in the hazardous areas as noted on the drawings.
2.4 EXPANSION FITTINGS FOR RIGID CONDUIT	.1	Weatherproof expansion fittings with internal bonding assembly suitable for linear expansion as required.
	.2	Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
	.3	Weatherproof expansion fittings for linear expansion at entry to building as required.
	.4	Provide expansion fittings at exit point (above-ground) of all underground services, and where indicated on the drawings.

2.5 FISH CORD .1 Polypropylene.

PART 3 - EXECUTION

3.1 CONDUIT  
INSTALLATION .1 General:

.1 Use rigid aluminum or rigid galvanized steel threaded conduit unless otherwise indicated.

.2 Use rigid PVC conduit, minimum size 27mm diameter for all direct buried underground services except use PVC coated rigid galvanized steel conduit to hazardous rated underground tanks. Refer to Section 33 65 76.

.3 Use PVC coated rigid galvanized steel or conduit above grade where indicated.

.4 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.5 In finished areas, conceal conduits. In all other areas, conduits may be surface mounted or concealed as determined during construction.

.6 In non-hazardous areas, use liquid tight flexible metal conduit for connection to vibrating equipment and instruments. In Zone 1/Zone 2 hazardous areas, use explosion-proof flexible couplings for connections to vibrating equipment and all instruments.

.7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend metallic conduit over 21 mm dia.

.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

.12 Provide minimum 300 mm spacing between instrumentation/control conduits and 600V power conduits. Where possible, instrumentation control conduits to cross at right angles to 600V power conduits.

.13 Install conduit sealing fittings in hazardous areas in accordance with Canadian Electrical Code requirements. Fill with compound. Seal all conduit leaving a hazardous area using an approved sealing fitting when conduit is continuous.

.14 Drawings do not show all required unions. Unions shall be installed to facilitate removal of equipment. Where seals are installed, install the unions between the equipment and the seal.



3.1 CONDUIT  
INSTALLATION  
(Cont'd)

- .1 General:(Cont'd)
  - .15 Install conduits to prevent low pockets where moisture can accumulate. Install a combination breather and drain fitting at the lowest point of each above-grade conduit system, which is unbroken by sealing fittings on other obstructions.
  - .16 Conduits must enter electrical equipment from the bottom only in wet/damp areas and outside.
- .2 Surface conduits:
  - .1 Run parallel or perpendicular to building lines.
  - .2 Group conduits wherever possible on suspended or surface channels.
  - .3 Do not pass conduits through structural members except as indicated.
  - .4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum 25 mm at crossovers.
  - .5 Fasten to flutes of metal roof deck when practical.
  - .6 Do not run conduits where they obstruct lifting devices such as monorails, cranes and hoists.
- .3 Concealed conduits:
  - .1 Do not install horizontal runs in masonry walls.
  - .2 Do not install conduits in concrete toppings.
  - .3 Run parallel or perpendicular to building lines.
- .4 Conduits underground: slope conduits to provide drainage.
- .5 Supply and install pull string in each spare conduit. Cap and seal conduit at each end.

PART 1 - GENERAL

- 1.1 SHOP DRAWINGS  
AND PRODUCT DATA .1 Submit shop drawings in accordance with Section  
01 33 00.
- .2 Drawings to include electrical detail of panel,  
branch breaker type, quantity, ampacity and enclosure  
dimension.
- 1.2 OPERATIONS AND  
MAINTENANCE DATA .1 Provide operations and maintenance data for  
panelboards for incorporation in to manual as  
specified in Section 01 78 00.
- .2 Include panel schedules.

PART 2 - PRODUCTS

- 2.1 PANELBOARDS .1 Panelboard:
- .1 Install circuit breakers in panelboards before  
shipment.
- .2 In addition to CSA requirements manufacturer's  
nameplate must show fault current that panel  
including breakers has been built to withstand.
- .2 Bus and breakers rated for the interrupting capacity  
(momentary rms symmetrical) as indicated on the  
drawings.
- .3 Sequence phase bussing with odd numbered breakers on  
left and even on right, with each breaker identified  
by permanent number identification as to circuit  
number and phase.
- .4 Panelboard: mains, number of circuits, and number  
and size of branch circuit breakers as indicated on  
the drawings.
- .5 Two (2) keys for each panelboard and key panelboards  
alike.
- .6 Tin-plated, copper busbars with neutral of same  
ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.

- 2.1 PANELBOARDS  
(Cont'd)
- .9 Trim and door finish: baked grey enamel.
  - .10 Provide panelboard complete with NEMA 12 enclosure.
  - .11 Surface mount panelboard unless noted otherwise.
- 2.2 BREAKERS
- .1 Breakers: as specified in Section 26 28 21.
  - .2 Bolt-on breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
  - .3 Lock-on devices for 10 % of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.
- 2.3 EQUIPMENT IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00.
  - .2 Nameplate for each panelboard size 9 engraved.
  - .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
  - .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Locate panelboard as indicated and surface mount securely, plumb, true and square, to adjoining surfaces.
  - .2 Connect panelboard to source transformer or circuit breaker as indicated.
  - .3 Connect loads to circuits.
  - .4 Connect neutral conductors to common neutral bus with respective neutral identified.
  - .5 Install type-written panel schedule in new panelboards.

PART 1 - GENEAL

- |   |    |  |
|---|----|--|
| <u>1.1 REFERENCES</u>                         | .1 | CAN/CSA C22.2 No. 248. 8-11, Low Voltage Fuses: Class J.                   |
|   | .2 | CAN/CSA C22.2 No. 248.4-00(R2015), Low Voltage Fuses: Class CC.            |
| <br><u>1.2 SHOP DRAWINGS AND PRODUCT DATA</u> | .1 | Submit shop drawings and product data in accordance with Section 01 33 00. |
| <br><u>1.3 MAINTENANCE MATERIALS</u>          | .1 | Three (3) spare fuses of each type and size.                               |
| <br><u>1.4 DELIVERY AND STORAGE</u>           | .1 | Ship fuses in original containers.   |
|   | .2 | Do not ship fuses installed.   |
|   | .3 | Store fuses in original containers in moisture free location.              |

PART 2 - PRODUCTS

- |                           |    |   |
|---------------------------|----|---|
| <u>2.1 FUSES GENERAL</u>  | .1 | Fuses: use the product of one (1) manufacturer.   |
|                           | .2 | Low voltage fuses, types as specified, shall be CSA certified in accordance with CSA Standard C22.2 No. 248.4 and 248.8.  |
| <br><u>2.2 FUSE TYPES</u> | .1 | All fuses must be high rupturing capacity (HRC) type, minimum 200kA interrupting rating (momentary RMS symmetrical).  |
|                           | .2 | Class J:<br>.1 Fuses rated 1 to 600 amperes, 600 Vac, shall be CSA certified Class J in accordance with Standard C22.2 No. 248.8.<br>.2 Where a time delay characteristic is required, fuses must carry 500% of their ampere rating for not less than 10 seconds and shall be clearly labeled "time delay". |

2.2 FUSE TYPES  
(Cont'd)

- .3 Class CC:  
.1 Fuses rated 1 to 30 amperes, 600 Vac, shall be CSA certified Class CC in accordance with Standard C22.2 No. 248.4.  
.2 Where a time delay characteristic is required, fuses shall carry 200% of their ampere rating for not less than 12 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.  
.2 Confirm correct fuses fitted to physically matched mounting devices.  
.3 Confirm correct fuses fitted to assigned electrical circuit.  
.4 Confirm fuse size is correctly identified on equipment.  
.5 For feeder circuit fuses, use fast acting Class J fuses unless otherwise noted.  
.6 For full voltage non-reversing motor starters, full voltage reversing motor starters, full voltage multi-speed motor starters and power distribution transformers, use time delay Class J fuses.  
.7 For 600Vac control circuits, use Class CC type fuses. Use time delay Class CC fuses upstream of control transformers and solenoids.

PART 1 - GENERAL

- |   |    |  |
|---|----|--|
| <u>1.1 SHOP DRAWINGS<br/>AND PRODUCT DATA</u> | .1 | Submit shop drawings and product data in accordance with Section 01 33 00. |
|---|----|--|

PART 2 - PRODUCTS

- |  |    |   |
|--|----|---|
| <u>2.1 BREAKERS<br/>GENERAL</u>              | .1 | Bolt-on moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.  |
|  | .2 | Common trip breakers: with single handle for multiple applications.   |
|  | .3 | Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 5 to 10 x current rating. |
|  | .4 | Circuit breakers with interchangeable trips as indicated.   |
|  | .5 | Circuit breakers to have interrupting rating (momentary RMS symmetrical) as indicated (minimum 10 kA at rated voltage).   |
|  | .6 | Half size circuit breakers are not acceptable.  |
| <br><u>2.2 THERMAL<br/>MAGNETIC BREAKERS</u> | .1 | Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping.   |
|  | .2 | Provide ground fault interrupter type for circuits so marked.   |
| <br><u>2.3 MANUFACTURERS</u>                 | .1 | To match panelboard manufacturer.   |

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install circuit breakers as indicated.

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This section and its associated drawings specifies the requirements for the supply, calibration, installation, cabling, termination, testing and commissioning of the instrumentation and controls equipment.
- .2 The Work also includes the following:
- .1 Supply and install termination junction boxes as indicated on the drawings and specified herein.
- .2 Supply and install instrumentation and controls cabling as indicated and as specified herein.
- .3 Install and terminate process equipment specified in other divisions. Refer to the vendor shop drawings for the instrumentation and controls equipment installation and termination details.
- .4 Assist the process equipment vendors as necessary during testing and commissioning of the new wastewater treatment system and associated controls and instrumentation.
- 1.2 RELATED WORK .1 Electrical - General Requirements: Section 26 05 00
- .2 Packaged Wastewater Treatment Facility: Section 44 42 11.
- .3 Effluent Pumping System: Section 33 36 16.
- 1.3 REFERENCES .1 Carry out the Work under this section in accordance with all applicable Federal, Provincial, Municipal and other laws, ordinances and with the latest edition of the following standards which shall be deemed to be and form part of this specification:
- .1 American Society of Mechanical Engineers.
- .2 Institute of Electrical and Electronic Engineers.
- .3 American Society for Testing Materials.
- .4 Manufacturers Standardization Society.
- .5 Canadian Standards Association.
- .6 Instrument Society of America.
- .7 Canadian Electrical Code.
- .2 In the event of a conflict between the above mentioned standards, this specification, or the attached drawings, notify the Departmental Representative who will then advise on which standard is to be followed.



- 1.4 SUBMITTALS .1 Submit shop drawings in accordance with Section 01 33 00. Have shop drawings reviewed and approved by the Departmental Representative before ordering any equipment.

PART 2 - PRODUCT

- 2.1 TERMINATION JUNCTION BOXES .1 Generally, instrumentation and control cables will run directly from the field device to the associated control panel. Where junction boxes are indicated, or otherwise deemed necessary, provide as follows:
- .1 Termination junction boxes must be NEMA 4X (stainless steel).
  - .2 In hazardous areas or where indicated, termination junction boxes must be suitable for the hazardous classification indicated on the drawings. Junction boxes must be stainless steel or die cast copper free aluminum.
  - .3 All termination junction boxes to have a pre-drilled and tapped copper ground bar and to be provided with a grounding lug for a #6 AWG external ground connection.
  - .4 Terminal blocks must be rated for at least 600V, 32A, minimum of 6mm wide, capable of accepting a 10 AWG conductor size, DIN rail mounted, complete with white marking tags with black lettering. The standard of acceptance is Weidmuller WDU4, or approved equivalent.
  - .5 Termination Junction Boxes must be adequately sized by the Supplier to accommodate the required hardware, terminal blocks, etc., as well as the number of cables to be glanded (bottom entry).
  - .6 Provide spare terminals in minimum quantities of 20% of used terminals of any one (1) strip.
  - .7 Wire analog and digital I/O signals to separate terminals strips and separate by a barrier.
  - .8 Provide junction boxes with hinged covers.
  - .9 All junction box hardware (hinges, latches, etc.) must be 316 SS. Provide all panels and junction boxes complete with a back mounting plate.
  - .10 Individually label all termination junction boxes with a lamicaid tag on the outside of the door and include the cabinet tag number. Nameplates to have a white background with black undercut lettering (316 SS screw mounted). Minimum lettering size to be 13mm.
  - .11 Arrange terminal blocks so that no more than two (2) wires are terminated on any one (1) terminal block (including field wiring). The use of "wire jumpers" between terminal blocks will not be permitted. Only terminal block vendor approved

2.1 TERMINATION  
JUNCTION BOXES  
(Cont'd)

- .1 (Cont'd)  
.11 (Cont'd)  
"cross-connection systems" can be used for cross wiring between terminal blocks.

2.2 INSTRUMENTATION  
CABLING/WIRING

- .1 24 Vdc instrumentation signal cables to be single or multi-paired (or triad), individually and overall shielded, #16 gauge copper conductors (tinned and stranded), 600V, XLPE insulation, with overall PVC jacket.
- .2 120 Vac instrumentation digital control cables to be multiconductor industrial control cable (type CIC), #14 or #16 gauge copper conductors (stranded), 600V, XLPE insulation with overall PVC jacket. Alternatively use single #14 AWG stranded copper conductors, 600V, RW90 insulation.
- .3 Handle, install and support cables in accordance with manufacturer's guidelines.
- .4 Ground shields for 24 VDC twisted pair and triad Instrumentation signal cables on the end supplying the loop power, and tape on the opposite end. All shield grounds must be continuous through any intermediate field junction boxes (individually terminated).
- .5 Ground 120 VAC multiconductor control cable grounds on both ends. When run through intermediate junction boxes, 120 VAC cable grounds are brought to a common junction box ground bar, and connected to earth ground via the junction box ground.
- .6 Ground control panels and termination junction boxes to nearest ground using a #6 green copper grounding conductor in conduit.
- .7 All cables and conduits must enter field instruments, control panels and junction boxes from the bottom only in process areas, wet/damp areas and outside. Use grounding bushings when terminating in non-conductive boxes or plates.
- .8 Identify conductors using wire markers (Weidmuller PT transparent sleeves with TM-I labels, or approved equivalent). Mark conductors with their corresponding instrument tag number and instrument terminal block number (ex: HS3004/C, where HS3004 is the Instrument tag number, and "C" is the Instrument terminal block number the conductor is terminated on). This

2.2 INSTRUMENTATION .8  
CABLING/WIRING  
(Cont'd)

- (Cont'd)
- "conductor identifier" must remain the same through any intermediate junction boxes, etc.
- .9 Clearly identify all cables at both ends with its cable number using flexible PVC slip-on wire markers on a carrier strip and fastened to the cable using chemical resistant ty-raps (Electrovert K-Markers, or approved equivalent). Provide labelling at all cable terminal points and on the armour at the point of junction box/instrument entry.
  - .10 Leave conductors being terminated within a junction box/control panel long enough to be removed from its assigned terminal block and reassigned to anywhere within the junction box/control panel.
  - .11 Coil spare conductors of a cable together inside its associated junction box/control panel and clearly identified with the cable number (ex: Spare-JB3000), unless indicated to be terminated on spare terminals. Leave adequate length to run the spare conductors anywhere within the junction box/control panel. Terminate spare conductors where identified.
  - .12 Fit stranded conductors with vinyl insulated wire end ferrules when terminating to terminal blocks, and vinyl insulated locking fork terminal connectors when terminating to screw terminals.

PART 3 - EXECUTION

3.1 TERMINATION  
JUNCTION BOXES

- .1 Install all termination junction boxes. The panel shop fabricator must include installation instructions for the proper handling and installation of the equipment.
- .2 Install and terminate all cables and equipment as per the drawings and the manufacturer's instructions.
- .3 Ground all controls and instrumentation equipment as per manufacturer's instructions (use min. #6).
- .4 Mount and position all equipment, etc., in such a way as to allow for easy access for maintenance purposes.
- .5 Store materials in a manner to ensure the preservation of their quality and fitness for the work, and to facilitate inspection by the Departmental Representative at any time. Keep

- 
- 3.1 TERMINATION .5 (Cont'd)  
JUNCTION BOXES  
(Cont'd)
- 
- 3.2 INSTALLATION .1 Install equipment neatly and per manufacturer's instructions.
- .2 Install all instrumentation and control equipment being supplied by, or issued to, where and as indicated on the drawings, and in accordance with the manufacturer's instructions. Manufacturer's installation instructions must be strictly adhered to.
- .3 The Drawings indicate the extent and general arrangement of the electrical system. Exact installation locations, distances and levels will be governed by actual field conditions.
- .4 If any departures from the original intent of the Drawings and/or the Specifications are deemed necessary by the Contractor, submit details of such departures with Drawings is necessary, together with reasons for the departure the Departmental Representative as soon as practical for approval. No such departure will be made without prior written consent of the Departmental Representative.
- .5 Fabricate and erect all support brackets and mounting brackets required. Contractor supplied instruments must be purchased with all necessary mounting brackets from the instrument vendor.
- .6 Locate instruments to minimize the possibility of damage from high temperature, vibration or humidity, and shall not interfere with, or be damaged by, maintenance of other equipment. Instrument installation must also provide for easy accessibility for operation, inspection, and maintenance purposes.
- .7 Protect installed equipment against water or dirt until it is commissioned. Use clear plastic sheeting of not less than 8-mil thickness for this purpose.
- .8 Coordinate equipment delivery, storage and installation requirements with other Division package vendors.
-

<u>3.3 TESTING AND CALIBRATION EQUIPMENT</u>	.1	Calibrate all test and calibration equipment to an industry recognized standard and have affixed proof of calibration along with date of next calibration.
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<u>3.4 COMMISSIONING AND START-UP</u>	.1	Refer to Section 01 91 13.
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PART 1 - GENERAL

1.1 RELATED  
SECTIONS

- .1 Environmental Protection: Section 01 35 43
- .2 Sanitary Sewer: Section 33 31 00
- .3 Hydraulic Seeding: Section 32 92 21

1.2 REFERENCES

- .1 ASTM D698-2012, Standard Test Methods for Laboratory Compaction Characteristics Of Soil Using Standard Effort (12,400 FT-LBF/FT<sup>3</sup>(600 KN-M/M<sup>3</sup>)).
- .2 ASTM C33-2013, Standard Specification for Concrete Aggregates.

1.3 DEFINITIONS

- .1 Unsuitable Material: all organic or other excavated material which is not suitable for use in work must be disposed of as defined by the Departmental Representative.
- .2 Rock: solid rock which requires drilling and blasting, wedging, sledging or barring or breaking up with power operated tools for its removal and boulders and pieces of concrete masonry exceeding one cubic metre (1m<sup>3</sup>) in volume.
- .3 Common: materials of whatever nature, which are not included under the definition of solid rock including dense tills, hardpan and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .4 Surplus material: excavated material not required for re-use.

1.4 PROTECTION OF  
EXISTING FEATURES

- .1 Existing buried utilities and structures:
  - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .2 Prior to commencing excavation work, notify Departmental Representative or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.
  - .3 Confirm locations of buried utilities by careful test excavations.

1.4 PROTECTION OF  
EXISTING FEATURES  
(Cont'd)

- .1 (Cont'd)
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone, process pipes and other utilities and structures encountered.
- .5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Advise Departmental Representative of existing lines in area of excavation that require removal or relocation and cost for such work.
- .6 Record location of maintained, re-routed and abandoned underground lines.
- .2 Existing surface features:
- .1 Conduct, with Departmental Representative, a condition survey of existing buildings, lawns, fencing, pipe racks, wires, pavement, survey bench marks and monuments which may be affected by work.
- .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of the Departmental Representative.

1.5 EXISTING  
UNDERGROUND  
PIPELINES

- .1 Be aware that underground pipelines are located within site boundaries. Prior to starting any excavation work, review any available as-built information to identify these pipelines clearly in the field. The Contractor is responsible to investigate and determine the presence of any underground utilities and shall repair any damage and/or pay all costs associated with damage to these existing utilities.

1.6 SUPPORT OF  
EXCAVATION

- .1 Suitably slope or properly shore sides of excavations according to site conditions, all in accordance with local requirements. Provide use of support as necessary.
- .2 The choice of any method of support shall be the responsibility of the Contractor. However, drawings and calculations for the method of support selected, designed by a qualified professional engineer in accordance with the local safety requirements, are to be submitted to the Departmental Representative for review before its use.
- .3 If it is desirable that any support, other than that which may be shown on the Drawings, be left in the excavations, then the Departmental Representative will issue instructions accordingly.

1.6 SUPPORT OF  
EXCAVATION  
(Cont'd)

- .4 Take every precaution against slips or falls, but if any should occur, at once make good the same. If any such slip or fall affects or may affect the stability of the permanent work, execute such remedial work as necessary, including filling up of any space left by the slip or fall with approved granular material. Submit proposed remedial work to Departmental Representative for review.

1.7 PERMITS

- .1 Obtain any required excavation permits for all areas to be excavated prior to starting any excavation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Select Backfill Material: common which is free from stumps, trees, roots, sod, organics; rocks, boulders and masonry larger than 200mm in any dimension; and other deleterious materials.
- .2 Granular Materials: crushed and screened, hard, durable stone, free from clay and organic matter, and graded as follows:
- .1 Clear stone, 28mm:

<u>Sieve Designation (micrometre)</u>	<u>Cum. % Passing</u>
28 000	5-100
14 000	25-60
5 000	0-10



2.1 MATERIALS  
(Cont'd)

.2 Granular Materials:(Cont'd)  
.2 Clear Stone, 80mm:

<u>Sieve Designation (micrometre)</u>	<u>Cum. % Passing</u>
80 000	100
56 000	25-60
28 000	0-5

.3 Granular Materials: crushed and screened rock or gravel, consisting of approved hard and durable stone particles, free from flat, elongated or other objectionable pieces. Gradation to be dense, uniform and as follows:

.1 Type 1:

<u>Sieve Size (micrometre)</u>	<u>Percent Passing</u>
20,000	100
14,000	50-85**
5,000	20-50
160	5-12
080	3-8*

.2 Type 2:

<u>Sieve Size (micrometre)</u>	<u>Percent Passing</u>
80,000	100
56,000	70-100
28,000	50-80
14,000	35-65
5,000	20-50
160	5-12
080	0-7*

\* For gravel sources not classified as quarries the allowable percentage passing the 080 sieve shall be 3 to 5%.

\*\* For gravel sources classified as quarries the allowable percentage passing the 14,000 sieve shall be 50 to 90%.

2.1 MATERIALS  
(Cont'd)  
(Cont'd)

- .3 Granular Materials:(Cont'd)  
.3 ASTM C33 #7, stone (crushed):

<u>Sieve Size (mm)</u>	<u>Percent Passing</u>
19,000	100
12,500	90-100
9,500	40-70
4,750	0-15
2,360	0-5

- .4 ASTM C33 #8 stone (crushed):

<u>Sieve Size (mm)</u>	<u>Percent Passing</u>
12,500	100
9,500	85-100
4,750	10-30
2,360	0-10

- .4 Sand bedding: hard granular, sharp freshwater material, well-graded from coarse to fine, free of impurities, chemicals and organic matter, and graded as follows:

<u>Sieve Size (mm)</u>	<u>Cum. % Passing</u>
5.0	100
0.16	0-5

- .5 Granular bedding materials: well graded, clear stone conforming to concrete aggregate as follows:

<u>Sieve Size (mm)</u>	<u>Cum. % Passing</u>
28	100
19	90-100
9.5	20-55
5	0-10
2.5	0-5

- .6 Structural Fill: crushed quarry-run material, nominal size 150mm or as determined by the Departmental Representative as conditions dictate.

- .7 Underground warning tape:  
.1 Detectable metallic tape, 50mm wide clearly marked as follows:  
.1 "CAUTION - BURIED SEWER LINE", colour GREEN.

- 2.1 MATERIALS (Cont'd) .7 Underground warning tape:(Cont'd)  
.2 Polyethylene, 3.5 mils thick, 75mm wide, clearly marked as follows:  
.1 "CAUTION - BURIED ELECTRICAL CONDUIT", colour RED.  
.3 Acceptable product: Brady Identoline or approved equivalent.

PART 3 - EXECUTION

- 3.1 STOCKPILING .1 Stockpile excavated materials for re-use in areas designated by Departmental Representative. Stockpile imported materials in manner to prevent segregation. Cover all materials to seal against rain.
- 3.2 SHORING AND BRACING .1 Construct temporary works to depths, heights and locations as approved by Departmental Representative.  
.2 During backfill operation:  
.1 Unless otherwise as indicated or as directed by Departmental Representative, remove sheeting and shoring from excavations.  
.2 Do not remove bracing until backfilling has reached respective levels of such bracing.  
.3 Upon completion of substructure construction:  
.1 Remove shoring and bracing.  
.2 Remove excess materials from site as directed by Departmental Representative.
- 3.3 EXCAVATION - GENERAL .1 Advise Departmental Representative forty-eight (48) hours before starting earthworks.  
.2 Excavate in all kinds of materials including rock encountered on Site and make own computations of amounts and nature of excavation required.  
.3 Select method of excavation, support and dewatering suitable for the works. Submit proposed method to Departmental Representative for review.  
.4 Protect property or structures above or below ground in accordance with the Contract.  
.5 Where excavation is to be performed through pavement or concrete, cut along neat, straight lines.

3.3 EXCAVATION -  
GENERAL  
(Cont'd)

- .6 Bear foundations or underside of all structures including pipe surrounds on the material as shown on the Drawings and finish all bearing surfaces to the required levels and grades.
- .7 Earth bottoms of excavations to be undisturbed soil, free from loose, soft, or organic matter. Remove any soil softened due to standing water prior to placing structures.
- .8 Excavation to greater depth than is shown on the Drawings shall be at no additional cost to the Contract, unless ordered by the Departmental Representative. Make good trench bottom with approved granular material adequately compacted as approved by the Departmental Representative or with concrete as may be necessary for the safety or stability of the Works.
- .9 Pile excavated material a safe distance away from sides of trench so it will not endanger personnel and the work, reduce sight distances, and obstruct roadways.
- .10 Leave existing utility controls unobstructed and accessible at all times.
- .11 Do not obstruct drainage ditches and natural watercourses.
- .12 The Departmental Representative reserves the right to require surplus material to be placed for embanking, general grading or other improvement or use on site.
- .13 Control grading so that the surface of the ground will be properly sloped to prevent water from running into excavated areas. Promptly remove any water which accumulates in excavations.
- .14 Dispose of any excess fill from the project outside of Parks Canada boundaries and in an approved disposal site at no additional cost to the Contract.

3.4 DRAINING,  
PUMPING AND  
THAWING

- .1 Keep excavations and trenches free of water. Control excavations to prevent surface water running into excavated areas.
- .2 Do work in connection with dewatering and supply and maintain on the work, pumps, in number and capacity

- 3.4 DRAINING,  
PUMPING AND  
THAWING  
(Cont'd)

.2 (Cont'd)  
sufficient to keep bottom of excavations dry and free from water so placing of pipe, manholes, and concrete will be done in the dry. Operate equipment for as long as necessary.

.3 Dispose of water removed from excavations in a manner that will prevent injuries to public health or private property or to any operation of the work completed or under construction. Do not pump water containing silt or other material in suspension into streams or drainage courses.

.4 All disposal of water from excavations to be done in accordance with Section 01 35 43.

.5 Confirm sub-drains, sump holes, wells or the like required for dewatering shall not endanger the stability of the Works. On completion of the work completely backfill and consolidate excavations.

3.5 STRUCTURE  
EXCAVATION

.1 Excavate to lines, grades, dimensions and elevations shown on Drawings.

3.6 TRENCH  
EXCAVATION

.1 Trenches for piping, conduit, and related excavations must be of sufficient width and depth at all points to allow pipes to be laid, joints to be formed, and appurtenance structures to be built in a workmanlike manner, and when needed, to allow for sheeting and shoring, pumping, draining, and for removing and replacing all materials unsuitable for foundations.

.2 Excavate trenches so pipe can be laid to the alignment and depth required. Excavation length to be not more than pipe length that can be laid and backfilled in one day. Brace and drain trench so workers may work safely and efficiently.

.3 Remove organic material and soft deposits to a depth where medium dense to dense materials are encountered as designated by the Departmental Representative.

.4 Do not stockpile excavated materials alongside trench if the bearing soil will cause trench side failure or bottom uplift and affect pipe alignment.

3.7 UNSUITABLE  
MATERIAL  
EXCAVATION AND  
BACKFILLING

- .1 Notify Departmental Representative when materials unsuitable for use in the work are encountered and remove to depth and extent as directed by Departmental Representative.
- .2 Backfill excavations with foundation material or selected backfill material as directed by the Departmental Representative.
- .3 Dispose of unsuitable material off-site, at no additional cost to the Contract.

3.8 GRANULAR  
BEDDING & SURROUND

- .1 Place granular bedding material in uniform layers not exceeding 150mm compacted thickness to depth as indicated.
- .2 Shape bed true to grade to provide continuous uniform bearing surface for pipe. Do not use blocks when bedding pipe.
- .3 Shape transverse depressions in bedding as required to suit joints.
- .4 Carry bedding material across actual trench width. Mounding bedding shall not be permitted.
- .5 Compact each layer full width of bed to at least 95% of standard Proctor dry density.
- .6 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material or foundation material as directed by the Departmental Representative.
- .7 After pipe installation, place and compact bedding to haunch line of pipe. Place and compact bedding material from haunch line of pipe to top of pipe in maximum 200mm layers. Place remaining bedding material to 300mm above top of pipe before further compaction. Compact to a density of 95% of standard Proctor density as determined by ASTM D698.

3.9 BACKFILLING-  
GENERAL

- .1 Do not proceed with backfilling operation until Departmental Representative has inspected and approved installations.
- .2 After pipelines, and structures have been built, backfill trenches and other excavated areas with materials shown on Drawings or as specified. Remove timber and debris from excavation before backfilling

- 3.9 BACKFILLING-  
GENERAL  
(Cont'd) .2 (Cont'd)  
is commenced. Do not cover up or put out of view any work until it has been examined, measured and approved by the Departmental Representative. If any work is covered without approval of the Departmental Representative it must, if required, be uncovered for examination at no extra cost.
- 3.10 BACKFILLING  
STRUCTURES .1 Excavation to be cleaned of trash and debris. Backfilling consists of material shown on Drawings. Place material to meet following requirements and approval of the Departmental Representative.  
.1 Place backfill in horizontal layers not more than 300mm deep.  
.2 Compact each layer by rollers, mechanical tampers, or other suitable equipment to obtain a density of not less than 100% standard Proctor density, unless noted otherwise.  
.2 Backfilling of tanks to meet manufacturer requirements as per latest installation guidelines.
- 3.11 BACKFILLING  
TRENCHES .1 Backfill trench from top of bedding to top of subgrade using materials shown on Drawings.  
.2 Place backfill in 300mm layers and compact to 95% standard Proctor density. Thoroughly compact each layer before placing next layer.  
.3 Leave surface of backfill initially high and repair settlement of trench backfilling.
- 3.12 MARKER TAPE .1 Place marker tape and plank in trenches above electrical conduits and pipes, where indicated.
- 3.13 REINSTATEMENT .1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as directed by Departmental Representative.  
.2 Reinstate disturbed areas to condition, elevation and thickness equal to or better than that, which existed before excavation.  
.3 Clean and reinstate areas affected by work as directed by Departmental Representative.

PART 1 - GENERAL

1.1 RELATED  
SECTIONS

- .1 Reinstatement: Section 32 98 00

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Provide product data for:
- .1 Topsoil.
  - .2 Seed.
  - .3 Mulch.
  - .4 Tackifier.
- .3 Submit in writing to the Departmental Representative four (4) days prior to commencing work:
- .1 Size of truck slurry tank in litres.
  - .2 Quantity of material to be used per tank based on size of slurry tank.
  - .3 Number of tank loads required per hectare to achieve specified slurry mixture per hectare.

1.3 SCHEDULING

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.

1.4 DELIVERY AND  
STORAGE

- .1 Deliver seed in original containers showing:
- .1 Analysis of seed mixture
  - .2 Percentage of pure seed
  - .3 Year of production
  - .4 Net mass
  - .5 Date when tagged and location
  - .6 Percentage germination

1.5 TESTING

- .1 Test soil prior to seeding. Apply lime or other soil amendment at rate determined from soil sample to bring pH level to 5.5 to 7.



## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Topsoil:
  - .1 Friable loam, neither heavy clay nor of very light sandy nature, containing minimum 4% organic matter for clay loam, and 2% for sandy loam, to maximum 20% by volume.
  - .2 Containing no toxic elements or growth inhibiting materials.
  - .3 Free from debris, subsoil, vegetation, and stones and roots over 50 mm diameter.
- .2 Soil amendments:
  - .1 Peatmoss:
    - .1 Derived from partially decomposed species of Sphagnum Mosses.
    - .2 Elastic and homogeneous, brown in colour.
    - .3 Free of wood and deleterious material which could prohibit growth.
    - .4 Shredded particle minimum size: 5mm.
  - .2 Limestone:
    - .1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85%.
    - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0mm sieve, 50% passing 0.125mm sieve.
  - .3 Fertilizer:
    - .1 Complete, commercial, with 35% soluble nitrogen.
- .3 Seed: Canada "Common No. 1" grade in accordance with Government of Canada "Seeds Act and Regulations".
  - .1 Grass seed mixture:
    - .1 40 % Creeping Red Fescue
    - .2 20 % Reubins Canada Bluegrass
    - .3 15 % Perennial Ryegrass
    - .4 15 % Birdsfoot Trefoil xx inoculated
    - .5 10 % Alsike Clover x inoculated
  - .2 In containers with original tags.
- .4 Mulch:
  - .1 Fibre: wood or wood cellulose fibre free of germination or growth-inhibiting ingredients, capable of dispersing in water to form homogenous slurry, and forming blotter- like green ground cover allowing absorption and percolation of water.
- .5 Fertilizer:
  - .1 Type 1: (in slurry) complete synthetic, minimum 65% water soluble nitrogen. Ratio 1:4:4.

- 2.1 MATERIALS (Cont'd)
- .5 Fertilizer:(Cont'd)
    - .2 Type 2: (during establishment) complete synthetic, slow release, with maximum 35% water soluble nitrogen. Ratio 2:1:1.
  - .6 Tackifier: water dilutable liquid dispersion containing polyvinyl acetate terpolymer emulsion.
  - .7 Water: potable, free of impurities that would inhibit germination.

- 2.2 EQUIPMENT
- .1 Truck:
    - .1 Slurry tank: approved commercial hydraulic equipment.
    - .2 Pumps capable of maintaining continuous non-fluctuating flow of solution.

PART 3 - EXECUTION

- 3.1 WORKMANSHIP
- .1 Take care to prevent contamination by seeding slurry of structures, signs, fences and utilities.
  - .2 Where contamination occurs, remove seeding slurry to satisfaction of, and by means approved by Departmental Representative.
  - .3 Do not perform work under adverse field conditions such as wind speeds over 20 km/h, or on frozen ground or ground covered with snow, ice or standing water.
  - .4 Perform hydraulic seeding in the spring after snow has melted.

- 3.2 PLACING TOPSOIL
- .1 Do not spread topsoil until subgrade has been inspected by Departmental Representative.
  - .2 Spread topsoil in uniform layer over dry subgrade where seeding is indicated. Do not place topsoil on frozen subgrade.
  - .3 Bring topsoil to finished grade.
  - .4 Apply topsoil to depth of 100 mm unless otherwise indicated.

3.2 PLACING  
TOPSOIL  
(Cont'd)

- .5 Fine grade topsoil to lines and elevations indicated, leaving material surface smooth and uniform with fine loose texture.
- .6 Obtain Departmental Representative's approval of topsoil grade and depth before starting seeding.

3.3 SLURRY  
APPLICATION

- .1 Slurry mixture applied per 100 m<sup>2</sup>.
  - .1 Seed: 2 kg.
  - .2 Mulch: 10 kg.
  - .3 Tackifier: 55 kg (if required)
  - .4 Fertilizer: 0.5 kg, Type 1, 5-20-20.
  - .5 Water: quantity as required to form slurry in accordance with manufacturer's recommendations.
- .2 Apply seed slurry uniformly.
- .3 Blend applications into adjacent grass, sodded areas and previous applications to form uniform surface.
- .4 Re-shoot areas where application is not uniform.

3.4 ESTABLISHMENT

- .1 Perform following operations from time of seed application until final acceptance by Departmental Representative.
  - .1 Water seeded area as required to maintain optimum soil moisture level and to ensure germination and continued growth of grass. Control watering to prevent washouts.
  - .2 Fertilize seeded areas one month after seeding. Spread evenly and water in well. Use Type 2 fertilizer, ratio 2:1:1 at rate determined by soil test. Postpone fertilizing until following spring if application falls within four week period prior to expected end local growing season.
  - .3 Repair dead or bare spots to allow establishment of seed prior to acceptance.

3.5 ACCEPTANCE

- .1 Areas will be accepted by the Departmental Representative at the end of the maintenance period provided that:
  - .1 Seeded areas are properly established.
  - .2 Area is free of bare and dead spots.
- .2 Areas seeded in the fall will be accepted the following spring one (1) month after the start of the growing season provided acceptance

3.6 MAINTENANCE  
DURING WARRANTY  
PERIOD

- .1 Perform following operations from time of acceptance until end of maintenance period:
  - .1 Water sodded Turfgrass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
- .2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.
- .3 Cut grass and remove clippings that will smother grass to height as follows:
  - .1 Turfgrass Nursery Sod:
    - .1 40 mm during normal growing conditions.
    - .2 65 mm at end of growing season and during periods of high temperatures and low precipitation.
  - .2 Cut grass at two (2) week intervals or as directed by Departmental Representative, but at intervals so that approximately one third of growth is removed in single cut.
  - .3 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
  - .4 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

PART 1 - GENERAL

- |                         |    |   |
|-------------------------|----|---|
| <u>1.1 RELATED WORK</u> | .1 | Excavation, Trenching and Backfilling: Section 31 23 10                         |
|                         | .2 | Hydraulic Seeding: Section 32 92 19   |
| <u>1.2 MAINTENANCE</u>  | .1 | Take care and maintain all reinstated areas until final acceptance of the work. |
|                         | .2 | Repair damaged areas to the approval of the Departmental Representative.        |

PART 2 - PRODUCTS

- |                      |    |   |
|----------------------|----|---|
| <u>2.1 MATERIALS</u> | .1 | Granular material: Type 1 and Type 2 gravel as specified in Section 31 23 10. |
|                      | .2 | Grass surfaces: to Section 32 92 19.  |

PART 3 - EXECUTION

- |                            |    |   |
|----------------------------|----|---|
| <u>3.1 GENERAL</u>         | .1 | Maintain surfaces to be reinstated level with adjoining existing surfaces until final reinstatement.  |
| <u>3.2 GRAVEL SURFACES</u> | .1 | Replace gravel in areas where existing gravel surfaces have been affected by the Works. Place gravel as shown on the drawings and compact to 98% standard Proctor density. Limits of gravel reinstatement will be as directed by the Departmental Representative. |
| <u>3.3 GRASS SURFACES</u>  | .1 | Repair grassed areas using the hydroseeding method to match existing.   |
-

3.4 MAINTENANCE DURING WARRANTY PERIOD	.1	Maintain all areas reinstated throughout the Maintenance Period. Respond to requests from the Departmental Representative to repair areas that are in dis-repair during this twelve (12) month period.
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PART 1 - GENERAL

- |                                   |    |   |
|-----------------------------------|----|---|
| <u>1.1 RELATED WORK</u>           | .1 | Trenching, Backfilling and Compaction: Section 31 23 10   |
|                                   |    |   |
| <u>1.2 REFERENCES</u>             | .1 | ASTM D1599-99(R2011), Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.   |
|                                   | .2 | ASTM D2564-2012, Specification for Solvent Cements for Poly(Vinyl-Chloride) PVC Plastic Piping Systems.   |
|                                   | .3 | ASTM D3035-2012e1, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.  |
|                                   | .4 | ASTM F714-2013, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.   |
|                                   | .5 | CSA B137 Series-2013, Thermoplastic Pressure Piping Compendium.   |
|                                   | .6 | CSA B1800 Series-2013, Plastic Non-pressure Pipe Compendium.  |
|                                   |    |   |
| <u>1.3 SHOP DRAWINGS</u>          | .1 | Provide shop drawings for all pipe, fittings, and all other items necessary for a complete installation in accordance with Section 01 33 00. Include details showing dimensions and tolerances of pipe and joint proposed.                                |
|                                   |    |   |
| <u>1.4 QUALITY ASSURANCE</u>      | .1 | All materials used, manufacturing operations, finished pipes and fittings will be subject to inspection by the Departmental Representative. Furnish all labour necessary to assist the Departmental Representative or or inspectors to inspect materials. |
|                                   |    |   |
| <u>1.5 MATERIAL CERTIFICATION</u> | .1 | At least two (2) weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this Section.   |

1.6 MATERIAL  
HANDLING AND  
STORAGE

- .1 Handle and store pipe and fittings in such a manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.
- .3 Store PVC pipe under opaque tarps.

PART 2 - PRODUCTS

2.1 POLYVINYL  
CHLORIDE EFFLUENT  
FORCEMAIN AND  
FITTINGS

- .1 Polyvinyl chloride (PVC) to CSA B137.3, pressure class 160 (DR 26) complete with bell gasketted and spigot fittings.
  - .1 Fitting to be series 200, IPS fittings rated at 200 psi

2.2 GRAVITY SEWER  
PIPE AND FITTINGS

- .1 Polyvinyl Chloride (PVC): to CSA-B182.2, DR28, Gasketted Bell and Spigot.

2.3 TRANSITION  
COUPLINGS

- .1 Concrete to PVC: sleeve and end rings to be cast iron with epoxy coating gaskets SBR Rubber, Fasteners 304 S.S.

2.4 MARKER TAPE

- .1 As specified in Section 31 23 10.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.
- .2 Provide proper implements, tools and facilities approved by the Departmental Representative, for the safe and convenient prosecution of the work. Take every precaution to prevent foreign material from entering the pipe.



3.2 TRENCHING  
AND BACKFILL

- .1 Do trenching and backfill work to Section 31 23 10.

3.3 PIPE BEDDING

- .1 Place granular bedding material to details indicated or directed.
- .2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .3 Shape transverse depressions in bedding as required to make joints.
- .4 Carry granular bedding material horizontally across actual trench width. Mounding bedding material will not be permitted.
- .5 After pipe installation, place and compact bedding material to center line of pipe. Place and compact bedding material from center line of pipe to top of pipe. Place remaining bedding material to 100 mm above top of pipe before further compaction.
- .6 Compact granular bedding to 95% relative density to ASTM D4254.

3.4 PIPE LAYING

- .1 Carefully lower pipe into the trench in such a manner as to prevent damage to coatings and linings. Do not drop or dump materials into trench.
- .2 Firmly and accurately set pipe to line and elevation on bedding material to the depth shown on the Drawings.
- .3 Check profiles at the commencement of work. Confirm grades and depths. Any variation will be made only at the order of the Departmental Representative. Set line of pipe by offset centreline. Set elevation by a method approved by the Departmental Representative.
- .4 Start laying pipe at lowest pipe and lay upgrade unless approved otherwise by the Departmental Representative. Ensure pipe maintains a positive upward slope.
- .5 Do not lay pipe when trench bottom is frozen or underwater or when trench conditions or weather are unsuitable.

- 
- 3.4 PIPE LAYING (Cont'd) .6 Temporarily support all pipe during assembly and install fittings in a manner to ensure pipe is not strained during jointing procedure. Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- 3.5 PIPE JOINTING .1 Align pipes carefully before jointing.
- .2 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gaskets and maintain concentricity until gaskets are properly positioned.
- .3 Maintain pipe joints clean and free from foreign materials.
- .4 Complete each joint before laying next length of pipe.
- .5 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations. Minimize deflection after joint has been made to avoid damage.
- .6 Install mechanical joint restraint on all 45 and 90 bends for pressure piping only.
- 3.6 MARKER TAPE .1 Place marker tape in trench where indicated.
- 3.7 PIPE FLUSHING .1 After installation and prior to testing, clean piping to remove foreign materials.
- .2 Notify Departmental Representative 24 hours before flushing.
- .3 Flush pipe with water through available outlets with sufficient flow to produce minimum velocity in main of 1.5 ft/s, for 10 minutes. Flush until foreign materials have been removed, and water is clear. Allow flush water to flow over land away from disturbed area.
- .4 Slowly open and close valves to ensure thorough flushing.
- .5 If satisfactory results cannot be achieved by flushing, swab pipes by approved methods and reflush.
-

### 3.8 TESTING

- .1 Gravity sanitary testing:
- .1 If water used for flushing or testing is obtained from a potable water supply, the potable water supply is to be continuously separated from the service being flushed or tested by an air gap or a level or protection equal to or greater than that provided by a double check valve backflow prevention device.
  - .2 Test each section of sewer. A section is the length of pipe between termination points, including service connections to the street line or termination point.
  - .3 Provide labour, equipment and materials required to perform testing.
  - .4 Notify Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.
  - .5 Flush sewers and related appurtenances to remove foreign materials per Section 3.8.
  - .6 Test pipes by filling tank per Section 44 42 11.
  - .7 Allowable leakage: determined by the following formula:

$$L = F \times D \times \frac{S}{100}$$

where:

L = allowable leakage in litres per hour  
D = diameter in mm  
S = length of section, in metres  
F = leakage factor, (litres per hour per mm of diameter per 100 metres of sewer):

- .2 Pressure sanitary testing:
- .1 If water used for flushing or testing is obtained from a potable water supply, the supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.
  - .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.
  - .3 Backfill prior to testing.
  - .4 Notify Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.
  - .5 Open all valves in test section.
  - .6 Expel air from main by slowly filling with water. Install corporation stops at high points where no air-vacuum release valves are installed. After testing, remove corporation stops and install plugs.

3.8 TESTING  
(Cont'd)

- .2 Pressure sanitary testing:(Cont'd)
- .7 Apply test pressure of 150 psi or pressure equal to 1.5 times working pressure, whichever is greater, measured at lowest point in test section. In any case, the test pressure shall not exceed 180 psi. Maintain pressure by pumping potable water from suitable container of known volume and record amount of water used for period of two (2) hours.
- .8 No leakage will be allowed during test period.
- .9 Define leakage as amount of water supplied from water storage container in order to maintain test pressure for two hours.
- .10 Locate and repair defects if test fails.
- .11 Repeat test (at no extra cost to contract) until leakage is within specified allowance for full length of watermain.
- .12 Repair visible leaks regardless of test results.
- .13 Provide all water used for testing at no additional cost to the Contract.

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This Section specifies requirements for supplying and installing. This section also specifies pumping equipment and electrical requirements for the effluent pumping system all as shown on the Drawings and as specified.
- 1.2 RELATED WORK .1 Excavating, Trenching and Backfilling: Section 31 23 10.
- .2 Sanitary Sewers: Section 33 31 00.
- .3 Electrical: Division 26.

PART 2 - PRODUCTS

- 2.1 EFFLUENT PUMP SYSTEM .1 Pump:
- .1 Two (2) duplex submersible centrifugal pumps with integral motors, suitable for use with final recirculating textile filter effluent, complete with lift out rail system for removing the pumps, to deliver 82 L/min at 6m TDH, and rated for minimum 100 on/off cycles/day.
- .2 Pump motor to be of the submersible type, 115 volts, single phase, 60 cycles.
- .3 Motors must be capable of operating over the full range of the performance curve without overloading the motor and causing any objectionable noise or vibration.
- .4 Equip motor with thermal overload and seal leak protection. The thermal overload protection should reset automatically when the motor cools down.
- .5 Motor power cord to be robust, suitable for outdoor operation, and sufficiently long to reach the control panel as shown in the drawings. The cord must have a sealing grommet to insulate electrical connections, prevent leaking of liquid into the motor housing, and provide strain relief for the power cord assembly.
- .6 Motor to be protected by a rotating mechanical shaft seal. Metal parts and springs for seals to be 300 series stainless steel.
- .2 Duplex control panel:
- .1 The pump manufacturer to supply one (1) completely assembled duplex control panel.

- 2.1 EFFLUENT PUMP SYSTEM (Cont'd)
- .2 Duplex control panel:(Cont'd)
- .2 The enclosure must be made to EEMAC 4X Standards. Mount the enclosure on the interior of the building wall.
- .3 Control panel to have 30A, 2-pole main circuit breaker.
- .4 Provide controller features with the following features:
- .1 Duplex alternating lead-lag operation.
- .2 Starter contactors complete with overload elements for each pump.
- .3 Motor circuit protectors for short circuit protection.
- .4 Inner door mounted running lights.
- .5 Hand-off auto selector switches.
- .6 Control circuit is to be fused.
- .7 Four (4) mechanical float switches with stainless steel mounting bracket.
- .8 High level alarm contact and over temperature alarm contact wired to red external alarm light and silenceable audible alarm.
- .9 Seal leak alarm contact wired to orange external alarm light.
- .10 Solid state alternating relay.
- .11 Override relay.
- .5 Complete control panel must be CSA certified.
- 2.2 VALVES
- .1 Ball valves:
- .1 Ball Valves: PVC body with EPDM seals and PTFE seats. True union design rated at 150 psi.
- .2 Ball check valves: PVC body with EPDM seals. True union design rated at 150 psi, but operable at low head (3-30 ft).
- 2.3 FLOAT SWITCHES
- .1 Refer to Section 44 42 11.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install pump, pump controls and discharge piping. Make all connections through the pump vault watertight.
- .2 Provide a written report from the pump manufacturer that equipment installed and operating to their satisfaction.
- .3 Provide a minimum of two (2) hours on site for equipment representatives for each piece of equipment installed. Representative to report to the Departmental Representative before leaving site with equipment fully functional.

## PART 1 - GENERAL

- |                             |    |  |
|-----------------------------|----|--|
| <u>1.1 RELATED SECTIONS</u> | .1 | Conduits, Conduit Fastenings and Conduit Fittings:<br>Section 26 05 34.  |
| <u>1.2 REFERENCES</u>       | .1 | Canadian Standards Association (CSA)<br>.1 CSA C22.2 No. 211.2-06, Rigid PVC<br>(Unplasticized) Conduit.<br>.2 CSA C22.2 No. 45.1-07 (R2012), Electrical Rigid<br>Metal Conduit - Steel. |

## PART 2 - PRODUCTS

- |  |    |   |
|--|----|---|
| <u>2.1 PVC CONDUIT AND FITTINGS</u>                  | .1 | Rigid PVC conduit: to CSA C22.2 No. 211.2, with<br>moulded fittings, for direct burial.   |
|  | .2 | Rigid PVC bends, couplings, reducers, bell end<br>fittings, plugs, caps, adaptors of same product<br>material as conduit to make complete installation. |
|  | .3 | Rigid PVC 90° and 45° bends.  |
|  | .4 | Rigid PVC 5° angle couplings.   |
|  | .5 | Expansion joints where conduits exit ground.  |
| <u>2.2 PVC COATED RIGID GALVANIZED STEEL CONDUIT</u> | .1 | PVC coated rigid galvanized steel conduit, fittings<br>and connectors: to CSA C22.2 No. 45.1.   |
|  | .2 | Provide expansion joints where the conduits exit the<br>ground.   |
| <u>2.3 SOLVENT WELD COMPOUND</u>                     | .1 | Solvent cement for PVC conduit joints.  |
| <u>2.4 CABLE PULLING EQUIPMENT</u>                   | .1 | 6 mm stranded polypropylene pull rope, tensile<br>strength 5 kN, continuous throughout each conduit run<br>with 3 m spare rope at each end.             |



PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install underground conduits in accordance with manufacturer's instructions.
- .2 Clean inside of conduits before laying.
- .3 Open trench completely before conduits are laid and ensure that no obstructions will necessitate change in grade of conduits.
- .4 Ensure full, even support every 1.5 m throughout conduit length.
- .5 Install conduits at elevations indicated and slope conduits with 1 to 400 minimum slope towards underground tanks.
- .6 During construction, cap ends of conduits to prevent entrance of foreign materials.
- .7 Pull through each conduits mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of conduit, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each conduits immediately before pulling-in cables.
- .8 In each conduits install pull rope continuous throughout each underground run with 3 m spare rope at each end.

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This Section specifies requirements for supplying and installing the Packaged WWTF as shown on the drawings and as specified.
- 1.2 RELATED WORK .1 Cast-in-Place Concrete: Section 03 30 00  
.2 Electrical: Division 26  
.3 Excavating, Trenching and Backfilling: Section 31 23 10  
.4 Sanitary Sewer: Section 33 31 00
- 1.3 REFERENCES .1 ASTM D698-2012, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).  
.2 ASTM D1785-2012, Standard Specification for PolyVinyl Chloride Plastic Pipe.  
.3 ASTM D3034-2008, Standard Specification for Type PSM PolyVinyl Chloride Sewer Pipe and Fittings.  
.4 ASTM D2321-2011, Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.  
.5 ANSI/AWWA D120-09, Thermosetting Fibreglass Reinforced Plastic Tanks.  
.6 CSA B66-10, Design, Material and Manufacturing Requirements for Prefabricated Septic Tanks.
- 1.4 DESIGN PARAMETERS .1 Peak wastewater flow = 42,000 Lpd (11,100 USgpd).  
.2 Wet weather flow = 84,000 Lpd (22,200 USgpd) (includes peak wastewater flow).  
.3 Waste type = campground wastewater.  
.4 Typical influent:  
.1 BOD: 600 mg/L.  
.2 TSS: 300 mg/L.

1.4 DESIGN  
PARAMETERS  
(Cont'd)

- .5 Effluent objective:
  - .1 BOD: 15 mg/L.
  - .2 TSS: 15 mg/L.
  - .3 Fecal: 200 colonies per 100 mL.

1.5 SUBMITTALS

- .1 All submittals to be in accordance with Section 01 33 00, with the following additional requirements for the process tanks:
  - .1 Product Data for FRP tanks:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Shop Drawings for FRP tanks:
    - .1 Design calculations for items designed by manufacturer.
    - .2 Finishing schedules.
    - .3 Methods of handling and erection.
    - .4 Storage facilities.
    - .5 Openings, sleeves, inserts and related reinforcement.
    - .6 Flotation calculations.
  - .3 Shop Drawings for Control Panel:
    - .1 Include wiring, single line schematic, diagrams and control narrative.

1.6 DELIVERY,  
STORAGE AND  
HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions. Coordinated delivery with Departmental Representative.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address, unload, store and protect on-site.
- .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 septic tanks from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FRP TANKS,  
ACCESS RISERS AND  
ACCESS LIDS

- .1 Provide single wall FRP underground tanks complete with tie down anti floatation system, internal piping and openings complete with risers to surface per drawing. Alternatively the PVC risers as specified can be attached to the tank.
- .2 Tanks: designed to ANSI/AWWA D120.

2.2 ACCESS RISERS  
WITH ACCESS LIDS

- .1 Risers: ribbed PVC or HDPE to CSA B182.4. Length and diameter as shown on drawings complete with locking access lids.
- .2 Access lids: constructed of fibreglass, or reinforced polyester, or PVC. Provide a gasketted watertight fit on the top of the riser and at connection to tank.
- .3 Where piping penetrates the access risers, seal the penetration using grommets of a diameter equivalent to that of the pipe.

2.3 RECIRCULATING  
AND DENITRIFYING  
PUMP SYSTEM

- .1 Pump System:
  - .1 Two (2) sets of two (2), duplex submersible effluent pumps: 3/4 Hp, 230 volt, single phase, 2 inch dia. discharge, to deliver 190 Lpm at 18m TDH and rated for minimum 300 on/off cycles per day. Pumps to be Class 1, Zone 2 rated.
  - .2 One (1) submersible effluent simplex pump: max. 1/2 Hp, 230volt, single phase, 9.5mm dia. discharge to deliver 76 Lpm at 17m TDH and rated for a minimum of 300 on/off cycles per day. Pumps to be Class 1, Zone 2 rated. Discharge may include orifice plate to throttle flow as required.
  - .3 Pump discharge assemblies must be suitable for intended operation. Provide valved drains on each assembly. Drilled holes in the components are not acceptable. Provide each discharge assembly complete with a PVC ball valve and check valve. Drill drain back hole in pump discharge line rather than discharge assembly, and provide barbed fitting and tubing to direct drain back flow into tank. Make connections to the pump discharge and the pressure sewer with PVC Schedule 40 unions. Configuration will be such that the pumps may easily be removed.
  - .4 Pump Power Cables: factory fitted with sufficient length of power cable to extend to

2.3 RECIRCULATING  
AND DENITRIFYING  
PUMP SYSTEM  
(Cont'd)

- .1 Pump System:(Cont'd)
  - .4 Pump Power Cables:(Cont'd)  
junction box where shown on the drawings. Cable suitable for Class 1 Zone 1 environment.
  - .5 Pumps to have thermal overload protection.
  - .6 Pumps to be located in preassembled pump vaults installed in support base in recirculation tank.

2.4 CONTROL PANEL

- .1 General: Supply and install a pre-packaged control panel with touch screen HMI capable of real-time monitoring and control over treatment system equipment and ancillary components, including alarm and control floats, recirculation pump system, anoxic return pump system, ventilation fan UV and flow meter operations. Panel to include NEMA 4X painted steel enclosure, elapsed time meter, event counter, intrinsically safe control relays and pump run lights.
- .2 System to allow the operator to log into the panel at the site using the HMI touchscreen and assess the system status by viewing a wide range of equipment status parameters which include but are not limited to: alarm status and history, pump status, float status, pump run times, pump cycle counts, average recirculation flow, discharge flow, UV intensity, daily average pump amp draw, etc. Make these parameters available to the operator in real time to facilitate action by the operator to address the alarm condition.
- .3 Data Logging: Detailed system parameters and operational data must be datalogged on the panel. The system must have the capability of storing this data for one (1) year. Make this data accessible for periodic download to computer for summarizing in spreadsheets and reports. Data must be down-loadable by using a flash drive or removable SD card. Provide any software required to manipulate data. Data logger to log the following:
  - .1 Alarms.
  - .2 Pump run hours.
  - .3 Average daily UV system intensity.
  - .4 Daily totalized flows.
- .4 Panel to include but not be limited to the following functions:
  - .1 Ability to maintain logs for system conditions and events, such as Pump Run Time, Pump Cycles, and Alarm Conditions.

2.4 CONTROL PANEL .4  
(Cont'd)

- (Cont'd)
- .2 Ability to assess flow conditions over a month and where required, adjust timer settings accordingly to reflect most recent flow data.
  - .3 Downloadable logs into a format for simple conversion to common spreadsheet or word processor programs.
  - .4 No proprietary computer software needed for remote monitoring and control.
  - .5 Multi-level password security to ensure that only qualified personnel can remotely access site.
  - .6 Simple interface using status, reference, and control parameters (Points). Points are viewable and editable by the operator. The following "point" types must be supported:
    - .1 Digital: on or off condition.
    - .2 Analog: numeric range ( $\pm 19,999,999.99$ ).
    - .3 Date: mm/dd/yy format.
    - .4 Time: 24 hour clock.
    - .5 Label: text (7 character max).
  - .7 Self-adjusting anti-condensation heater.
  - .8 HOA selector switches for each pump.
  - .9 Provide surge protection on the incoming power supply.
  - .10 Mount flow meter transmitter and UV monitor in the control panel enclosure with plexiglass window to allow viewing.
  - .11 Provide panel general arrangement layouts, schematic drawings, wiring termination schedules and a bill of materials with shop drawings submission. Provide manual for timer operation.
- .5 Panel Float Monitoring and Control: Include the following monitoring and control functionality at a minimum:
- .1 Septic Tank:
    - .1 High Level Alarm float.
  - .2 Recirc Tank (Timed Dosing) (Duplex).
    - .1 High level alarm/lag pump enable float.
    - .2 Override timer float.
    - .3 Timer will be active as long as the RO float is raised.
    - .4 Redundant off/low level alarm float.
  - .3 Recirc Tank (Anoxic Return) (Simplex):
    - .1 Utilizes recirc system floats.
  - .4 Ventilation Fan:
    - .1 Fan fail current sensor.
  - .5 UV System:
    - .1 UV fail dry contact input.
    - .2 UV intensity
  - .6 Flow Meter (Loop Powered):
    - .1 4-20 mA input.

2.4 CONTROL PANEL  
(Cont'd)

- .5 Panel Float Monitoring and Control:(Cont'd)
- .7 Effluent Pump Station (monitoring only):
  - .1 High level alarm float.
  - .2 Pump fail alarms.
- .8 Alarms:
  - .1 Alarm test switch.

2.5 TREATMENT  
MODULES

- .1 Media to be synthetic and system to be third party validated by BNQ Standard NQ3680-910 stand alone wastewater treatment systems, Class II secondary treatment or NSF 40 residential wastewater treatment Class F.
- .2 Spray nozzles must be removable. Inlet piping to have a valve and pressure gauge connection for use in setting inlet pressure.
- .3 Exterior sides of the modules to have a minimum of 75mm of spray insulation applied. Provide the cover with 50mm thick rigid insulation attached on the inside. Spray insulation to be suitable for buried conditions.
- .4 Install media in 8 ft wide x 16 ft long fibreglass enclosure with insulated hinged access cover, complete with stainless steel fastenings.

2.6 FLOAT SWITCHES

- .1 Mechanical type suitable for intrinsic safe installation. Cable to be type SJOOW or equivalent and be supplied in sufficient length of cable to extend to junction box where shown on the Project Drawings.
- .2 Floats may be mounted as single assembly on float stem with float collars, or top mounted.
- .3 One (1) SPDT contact, rated for at least 5 amps at 120 VAC (continuous use).

2.7 RECIRCULATING  
SPLITTER VALVE

- .1 Provide Schedule 40 PVC unions and couplings to match underdrain piping. The recirculation rate must be adjustable from 1 to 4 times the inflow rate. (Initial setting 4 to 1).
- .2 Materials of construction: Schedule 40 PVC.

2.8 DISTRIBUTION  
VALVE ASSEMBLY

- .1 Provide as a complete assembly including inlet ball valve, distributing valve with three (3) outlet ports, Schedule 80 unions for removal and cleaning, and clear PVC ports for inspection. Valve manufactured of corrosion resistant ABS polymer, stainless steel, and die-cast metal. Each distributing valve to include the following:
  - .1 Distributing valve assembly shall be enclosed in a 600mm diameter access riser with cover. The riser and lid combination must be watertight and support a 2500 lb. wheel load.
  - .2 Rigid closed-cell foam insulation of 50mm thickness shall be mechanically attached to the underside of the lid. Use fasteners made of corrosion resistant stainless steel. Insulation to have an R-value of no less than 10 per 50mm increment.
  - .3 Provide sams and install to allow each distribution valve to operate two outlet ports.

2.9 VALVES

- .1 Ball Valves: PVC body with EPDM seals and PTFE seats. True union design rated at 150 psi.
- .2 Ball Check Valves: PVC body with EPDM seals. True union design rated at 150 psi, but operable at low head (3-30 ft).
- .3 Gate valves: high impact PVC type II body with polypropylene paddle and non-rising stem.

2.10 UV SYSTEM

- .1 General: one (1) stand alone U.V. disinfection system complete with power cable(s), level control device, U.V. lamps and lamp supports, electronic ballasts, GFCI receptacles and accessories as noted in this section including one (1) UV monitoring system for monitoring lamp age and UV intensity.
- .2 Application/Design: system to be designed to disinfect peak flow of 114 Lpm of effluent from recirculating textile filter sewage treatment process to maximum fecal coliform concentration of 200/100 ml measured on a 30 day geometric average. Design system based on 50% UVT and Section 1.4 herein.
- .3 Lamp Modules: individual lamp modules to contain ultraviolet lamps with electronic ballasts in an aluminum enclosure mounted on a 316 stainless steel frame. Do not expose electrical wires and connections to moisture.



2.10 UV SYSTEM  
(Cont'd)

- .4 Effluent Channels: provide a single fabricated, modular, type 304 stainless steel channel. Fasten the channel to transition boxes, which are attached to an equipment pad as shown on the drawings. Connect the channel to a transition box on each end with 100mm inlet connection and 100mm outlet connection.
- .5 Provide the following spare parts:
  - .1 Four (4) UV lamps.
  - .2 Four (4) Quartz sleeves.
  - .3 Four (4) lamp end seals.
- .6 All components must be CSA approved.
- .7 Power cables to be not less than 2m.

2.11 SEPTIC TANK  
EFFLUENT FILTER

- .1 System to be accessible at finished grade and removable with a lift out filter system, including a slide rail and all accessories and apparatus.
- .2 Filter to be capable of removing all solids greater than 1/8" and designed to have a cleaning frequency of one per year based on sated flows. Filters to be sized to allow removal by one (1) person.
- .3 Locate inlet holes at 50% of liquid depth.
- .4 Provide float system to detect high septic tank liquid level indicating dirty filter.

2.12 FLOW METER

- .1 Magnetic flow meter as specified below. Flow tube must be hard rubber of the "formed" type, complete with SS grid backing. Flow tube diameter to be as indicated on the Project Drawings.
- .2 Minimum 316 SS, self-cleaning electrodes.
- .3 Supply grounding hardware in accordance to manufacturer's recommendations.
- .4 Mount the flow transmitter remotely from the flow tube where specified. Flow tube to be complete with integral cable (length to suit each application and to be determined by the Contractor) for connection to the flow transmitter.
- .5 Flow transmitter and flow tube to have a minimum enclosure rating of NEMA 4X.

2.12 FLOW METER  
(Cont'd)

- .6 Flow transmitter to be programmable locally using keypad via simple menu-driven software, and to be complete with integral display showing flow rate with engineering units, and totalized flow.
- .7 Online diagnostics of flow sensor and electronics, including process checks, linearity and calibration checks. Operator alarm notification via transmitter display, relay outputs, and output signal (4-20 mA upscale/downscale manipulation).
- .8 4-20 mA output of flow rate, self-powered, isolated. Frequency pulse output (dry contact) for flow totalization.
- .9 Minimum system flow accuracy to  $\pm 0.5\%$  of reading.
- .10 Have adjustable damping ability.
- .11 An adjustable low flow cutoff.
- .12 Transmitter language to be English.
- .13 Refer to Electrical drawings for process requirements.

2.13 VENTILATION  
ASSEMBLY

- .1 Fan to be CSA approved, 120V, single phase, 245 CFM at 0 inch H<sub>2</sub>O.
- .2 Provide 150mm diameter activated carbon filtration system for exhaust air complete with three (3) replacement filters carbon refills, as applicable.
- .3 Fan to be preassembled in PVC or FRP basin.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Handle and install equipment in strict accordance with manufacturer's instructions. Issue instructions at time of shop drawing issue and make available on site when required.
- .2 Provide concrete equipment attachments as required by the equipment and as shown on the Drawings.
- .3 Provide small connecting pipework, fittings and valves whether shown on the Drawings or not but required for proper functioning and servicing of the equipment. Do work in accordance with the

- 3.1 INSTALLATION (Cont'd) .3 (Cont'd)  
manufacturer's instructions at no additional cost to the Contract. Where pipe is connected to equipment, fit pipe in a manner such that neither pipe equipment is strained during the joining procedure.
- 3.2 FRP TANK INSTALLATION .1 Refer to 31 23 10 for backfilling.
- .2 Hydrostatically test tank for 24 hours according to manufacturer's requirements. Repair any leaks and retest. Repeat until all leaks are repaired at no extra cost.
- .3 Once backfilled and all pipes connected fill 450mm up riser and repeat as above to test interconnecting pipes.
- .4 Tank installation and testing to follow manufacturer's requirements in effect at time of installation.
- 3.3 LUBRICATION .1 Provide complete initial lubrication of all equipment in accordance with the equipment manufacturer's recommendations.
- 3.4 RESPONSIBILITY OF TEMPORARY TRIAL USAGE .1 Obtain written permission from the Departmental Representative to use and test permanent equipment and systems prior to acceptance by the Departmental Representative.
- .2 The guarantee period must not be affected by temporary trial use of the equipment.
- .3 Clean and renew equipment and systems used before acceptance. Restore to original or new working condition.
- .4 Protect equipment and systems openings from dirt, dust and other foreign materials during temporary usage.
-

3.5 INSPECTION,  
TESTING AND  
START-UP

- .1 Provide the services of competent servicemen, mechanics or other trained personnel of the equipment supplier's or manufacturer's to check the complete installation and be present for start-up of the equipment. Submit a written report signed by the equipment manufacturer's representative to the Departmental Representative stating the following:
  - .1 That a satisfactory installation of equipment has been performed and outlining any modifications that have been made as a result of the commissioning or testing of the equipment at no additional cost to the Contract.
  - .2 That the equipment is now ready for permanent operation;
  - .3 Test installed equipment with actual plant operation to verify hydraulic balancing, head loss and effluent quality. Make adjustments required to place equipment into operation and to optimize the treated water quality. Testing of treated effluent quality to take place 3-6 weeks after the date the plant is put in service. This may occur in spring/summer 2016 when campground is operating.
- .2 The equipment manufacturer's representative will fully instruct the permanent operator of the equipment in the proper operation and maintenance of all equipment at no additional cost to the Contract.
- .3 Advise in writing at least one (1) week in advance of the proposed date for testing and start-up. Conduct all tests in the presence of the Departmental Representative.
- .4 Replace defective material or equipment with new material or equipment. Bear costs including re-testing and repairing.
- .5 A minimum period of four (4) days on site for skilled supervision and instruction and a minimum of two (1) trips to the site should be assumed by the equipment manufacturer. Provide as many trips and days on site to complete the installation and put the equipment into satisfactory operation, including time at site required to inspect the progress of the construction works as it pertains to said equipment.
- .6 Provide training and demonstration of the equipment to the Park maintenance staff in accordance with Section 01 79 00.

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3.6 IDENTIFICATION .1 Locate manufacturer's nameplates so that they are easily read. Do not paint over plates.