



# Public Works and Government Services Canada

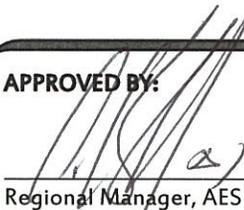
Requisition No. E0276-142034/A

MERX I.D. No. \_\_\_\_\_

SPECIFICATIONS  
for  
ONSITE WASTEWATER DISPOSAL AND TREATMENT SYSTEM  
QUEEN CHARLOTTE CITY, B.C.

Project No. R. 064179.001  
December 2013

**APPROVED BY:**

  
\_\_\_\_\_  
Regional Manager, AES

DEC 13/2013

\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Construction Safety Coordinator

2013-12-11

\_\_\_\_\_  
Date

**TENDER:**

  
\_\_\_\_\_  
Project Manager

13/12/14

\_\_\_\_\_  
Date

**SPECIFICATIONS**

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<b>Division 01</b>	<b>General Requirements</b>	
01 11 05	General Instructions	4 pages
01 33 00	Submittal Procedures	5 pages
01 35 33	Health and Safety Requirements	8 pages
01 35 43	Environmental Procedures	2 pages
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01 74 21	Construction Demolition, Waste Management and Disposal	9 pages
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03 30 00	Cast-in-Place Concrete	6 pages
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33 31 13	Public Sanitary Utility Sewerage Piping	7 pages
33 34 00	Sanitary Utility Sewerage Force Mains	6 pages
33 36 01	Utility Septic Tanks and Wastewater Treatment Systems	7 pages
33 36 33	Utility Drainage Field	5 pages

**DRAWINGS**

**Bound Separately**

C0	Cover Sheet
C1	Key Plan
C2	Utility Drainage Field Details
C3	Detail of Treatment Tanks

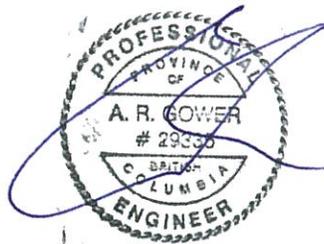
**APPENDICES**

**Bound Separately**

Waste Water Rehabilitation Feasibility Report – Wedler Engineering LLP (edited for Tender purposes)
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15 pages

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14 Jun 2014

**PART 1 - GENERAL**

<p><b>1.1</b>    Location of Site</p> <hr/>	<p>.1</p> <p>.2</p>	<p>The work is located at the Parks Canada Facility at 1325 Cemetery Road, Queen Charlotte City, BC.</p> <p>The site of work is on the federally owned land on which the Parks Canada facilities are located.</p>
<p><b>1.2</b>    General Description of Work</p> <hr/>	<p>.1</p> <p>.1</p> <p>.2</p> <p>.3</p> <p>.4</p> <p>.5</p> <p>.6</p>	<p>The principal works to be executed and for which all materials, plant and labour are to be supplied by the Contractor as shown in the plans and specifications:</p> <p>Supply and installation of Type III package sewage treatment plant.</p> <p>Supply and installation of sewage effluent pump station.</p> <p>Supply and installation of utility drainage septic field.</p> <p>Connection of sewage treatment and disposal system to existing sanitary sewage system.</p> <p>Testing and commissioning of sewage treatment system.</p> <p>Supply all required close-out submittals including detailed operations and maintenance manuals and mark-up as-built drawings.</p>
<p><b>1.3</b>    Related Sections</p> <hr/>	<p>.1</p>	<p>Section 01 35 33 – Health and Safety Requirements.</p>
<p><b>1.4</b>    Codes and Standards</p> <hr/>	<p>.1</p>	<p>Meet or exceed requirements of specified standards, codes and referenced documents.</p>

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| <p><u>1.5 Required Documents</u></p>    | <p>.1</p> | <p>Maintain one copy at job site:</p> <ul style="list-style-type: none"> <li>.1 Contract drawings, Safety Plan and Waste Reduction Workplan.</li> <li>.2 Specifications.</li> <li>.3 Addenda</li> <li>.4 Change orders</li> <li>.5 Other modifications to contract</li> <li>.6 Copy of approved work schedule</li> <li>.7 Health and Safety plan.</li> <li>.8 Environmental Emergency Response Plan ( including Spill Response Plan )</li> </ul>                                 |
| <p><u>1.6 Drawings</u></p>              | <p>.1</p> | <p>Contract Drawings:</p> <ul style="list-style-type: none"> <li>.1 Following contract award, four (4) full size sets of the drawings will be provided.</li> </ul> <p>.2 Record Drawings:</p> <ul style="list-style-type: none"> <li>.1 As work proceeds, maintain accurate records to show all deviations from the contract drawings. Note on as-built drawings as changes occur and at completion supply one set of all drawings and specifications clearly marked.</li> </ul> |
| <p><u>1.7 Site Condition</u></p>        | <p>.1</p> | <p>Make inquiries or investigations necessary to become thoroughly acquainted with site, soil, surface, stream and road access conditions, and the nature and extent of the work.</p>  |
| <p><u>1.8 Ground Condition Data</u></p> | <p>.2</p> | <p>Submission of a tender will be deemed confirmation that the Contractor is acquainted with the site and is conversant with all relevant conditions.</p>  |
| <p><u>1.8 Ground Condition Data</u></p> | <p>.1</p> | <p>The Departmental Representative has no detailed ground condition data for this site.</p>  |

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| <p><u>1.9</u>    <u>Layout of Work</u></p>                | <p>.1</p> <p>.2</p> <p>.3</p>           | <p>Construction layout is the responsibility of Contractor.</p> <p>Point Files and survey data will be made available by the Departmental Representative.</p> <p>Notify Departmental Representative immediately if the work cannot be completed as shown in the plans and specifications.</p>   |
| <p><u>1.10</u>    <u>Assistance by the Contractor</u></p> | <p>.1</p>                               | <p>Provide access to the work areas as required for the Departmental Representative to perform their duties.</p>  |
| <p><u>1.11</u>    <u>Time of Completion</u></p>           | <p>.1</p>                               | <p>Complete all work under the contract within eight (8) weeks of award.</p>  |
| <p><u>1.12</u>    <u>Work Schedule</u></p>                | <p>.1</p> <p>.1</p>                     | <p>Within 5 days of Contract award, provide a schedule of work. Observe the following requirements:</p> <p>.1    Whenever a variation from the schedule in excess of 5 working days occurs or is expected to occur, notify Departmental Representative of the change.</p>   |
| <p><u>1.13</u>    <u>Use of Site</u></p>                  | <p>.1</p> <p>.2</p> <p>.1</p> <p>.2</p> | <p>Use of site is limited to work areas required for the work, including the storage of materials and equipment and to the access routes assigned by the Departmental Representative required for the completion of work as specified. Access keys will be provided to the contractor as required.</p> <p>Hours of work to comply with local airport authority.</p> <p>.1    Perform work between normal hours of 08:00 to 16:00, Monday to Friday, except holidays.</p> <p>.2    Work may be performed after working hours, on weekends and holidays as approved by Departmental Representative.</p> |

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| <u>1.14 Project Meetings</u>                   | .1 | The Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.   |
| <u>1.15 Location of Equipment and Fixtures</u> | .1 | Location of existing equipment and fixtures indicated or specified is to be considered as approximate.  |
| <u>1.16 Inspection Services</u>                | .1 | Inspections will be carried out by Departmental Representative.   |
|  | .2 | Where inspections reveal that work is not in accordance with the contract requirements, additional inspections to confirm acceptability of the corrected work will be conducted at the expense of the Contractor. |
| <u>1.17 Interpretation</u>                     | .1 | In interpreting the Contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.                              |
|  | .2 | In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between:   |
|  | .1 | the Plans and Specifications, the Specifications govern;  |
|  | .2 | the Plans, the Plans drawn with the largest scale govern; and   |
|  | .3 | figured dimensions and scaled dimensions, the figured dimensions govern.  |
| <u>1.18 Safe Companies Certification</u>       | .1 | The Contractor must ensure that all works are performed by contractors who are one of the following:  |
|  | .1 | Have current WCB registration and clearance;  |
|  | .2 | Have required WHIMIS training;  |

END OF SECTION

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PART 1 - GENERAL

1.1 Administrative

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- .1 Submit to Departmental Representative submittals listed under each Section 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 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .5 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are co-ordinated.
- .7 The review of the Environmental Emergency Response Plan by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

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1.2 Submittals

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- .1 Allow 5 days for Departmental Representative's review of each submission.
- .2 Adjustments made to submitted plans 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.
- .3 Make changes to submitted plan as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .4 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .5 Submissions shall include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract documents.

- .5 Details of appropriate portions of work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions (including identified field dimensions) and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
- .6 After Departmental Representative's review, distribute copies.
- .6 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, Work may proceed. If submitted plan is rejected, noted copy will be returned and resubmission of corrected plan, through same procedure indicated above, must be performed before Work may proceed.
- .7 All submissions to be made electronically in Adobe Acrobat ".PDF" format.
- 1.3 Certificates and Transcripts

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  - .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- 1.4 Shop Drawings

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  - .1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portions of work which are specific to project requirements.
  - .2 Maximum sheet size: 850 X 1050 mm.
  - .3 Submit 6 prints of shop drawings for each requirement requested in the specification sections and/or as requested by the Departmental Representative.
  - .4 Cross-reference shop drawing information to applicable portions of the Contract documents.

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1.5 Shop Drawings  
Review

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- .1 Review of shop drawings by Public Works and Government Services Canada is for the sole purpose of ascertaining conformance with the general concept.
- .2 This review shall not mean that Public Works and Government Services Canada approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same.
- .3 This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract documents.
- .4 Without restricting the generality of the foregoing, the Contractor is responsible for:
  - .1 Dimensions to be confirmed and correlated at the job site.
  - .2 Information that pertains solely to the fabrication processes or to techniques of construction and installation.
  - .3 Coordination of the work of all the sub-trades.

1.6 Product Data

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- .1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products or any other specified information.
- .2 Delete information not applicable to project.
- .3 Supplement standard information to provide details applicable to project.
- .4 Cross-reference product data information to applicable portions of Contract documents.
- .5 Submit 6 copies of product data.

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1.7 Samples

- .1 Samples: examples of materials, equipment, quality, finishes and workmanship.
- .2 Reviewed and accepted samples will become the standard of workmanship and material against which installed work will be verified.

END OF SECTION

<p>1.1 <u>References</u></p>	<p>.1 Government of Canada.                  .1 Canada Labour Code - Part II                  .2 Canada Occupational Health and Safety Regulations.                  .2 National Building Code of Canada (NBC):                  .1 Part 8, Safety Measures at Construction and Demolition Sites.                  .3 Canadian Standards Association (CSA) as amended:                  .1 CSA Z797-2009 Code of Practice for Access Scaffold                  .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes                  .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures                  .4 Province of British Columbia:                  .1 Workers Compensation Act Part 3-Occupational Health and Safety.                  .2 Occupational Health and Safety Regulation</p>
<p>1.2 <u>Related Sections</u></p>	<p>.1 Refer to the following sections as required:                  .1 General Instructions: Section 01 11 05                  .2 Earthworks for Minor Works: Section 31 00 99</p>
<p>1.3 <u>Workers' Compensation Board Coverage</u></p>	<p>.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.                  .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.</p>

1.4 Compliance with Regulations

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- 1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 Submittals

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- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
  - .1 Health and Safety Plan.
  - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
  - .3 Copies of incident and accident reports.
  - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
  - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .5 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.

- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
  - .1 Be construed to imply approval by the Departmental Representative.
  - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
  - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.
  
- 1.6 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.
  - .3 The Contractor is to assume the role of the “prime contractor” for the duration of the job
  
- 1.7 General Conditions
  - .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
  - .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
    - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
  
- 1.8 Project/ Site Conditions
  - .1 Work at site will involve contact with:
    - .1 Unknown buried utilities and infrastructure.
    - .2 Pipes under pressure.
    - .3 Excavations.

- .4 Heavy machinery (if necessary).
  - .5 Live electrical equipment.
- 1.9 Regulatory Requirements
- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
  - .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.
- 1.10 Filing of Notice
- .1 The Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
  - .2 Provide copies of all notices to the Departmental Representative.
- 1.11 Health and Safety Plan
- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
  - .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
    - .1 Primary requirements:
      - .1 Contractor's safety policy.
      - .2 Identification of applicable compliance obligations.
      - .3 Definition of responsibilities for project safety/organization chart for project.
      - .4 General safety rules for project.
      - .5 Job-specific safe work, procedures.

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- .6 Inspection policy and procedures.
  - .7 Incident reporting and investigation policy and procedures.
  - .8 Occupational Health and Safety Committee/ Representative procedures.
  - .9 Occupational Health and Safety meetings.
  - .10 Occupational Health and Safety communications and record keeping procedures.
- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
  - .3 List hazardous materials to be brought on site as required by work.
  - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment (PPE) to be used by workers.
  - .6 Identify personnel and alternates responsible for site safety and health.
  - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/ activities of subcontractors are included in the hazard assessment and are reflected in the plan.
  - .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
  - .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

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- 1.12 Emergency Procedures
- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
    - .1 Designated personnel from own company.
    - .2 Regulatory agencies applicable to work and as per legislated regulations.
    - .3 Local emergency resources.
    - .4 Departmental Representative [site staff].
  - .2 Include the following provisions in the emergency procedures:
    - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
    - .2 Evacuate all workers safely.
    - .3 Check and confirm the safe evacuation of all workers.
    - .4 Notify the fire department or other emergency responders.
    - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
    - .6 Notify Departmental Representative.
  - .3 Provide written rescue/evacuation procedures as required for, but not limited to:
    - .1 Work at high angles.
    - .2 Work in confined spaces or where there is a risk of entrapment.
    - .3 Work with hazardous substances.
    - .4 Underground work.
    - .5 Work on, over, under and adjacent to water.
    - .6 Workplaces where there are persons who require physical assistance to be moved.
  - .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
  - .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

<p><u>1.13 Hazardous Products</u></p>	<p>1</p> <p>.2</p> <p>.1</p> <p>.2</p> <p>.3</p>	<p>Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.</p> <p>Where use of hazardous and toxic products cannot be avoided:</p> <p>Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.</p> <p>In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.</p> <p>Provide adequate means of ventilation in accordance with Section 01 51 00.</p>
<p><u>1.14 Fire Safety Requirements</u></p>	<p>.1</p> <p>.2</p>	<p>Store oily/ paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.</p> <p>Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.</p>
<p><u>1.15 Unforeseen Hazards</u></p>	<p>.1</p>	<p>Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.</p>
<p><u>1.16 Posted Documents</u></p>	<p>.1</p> <p>.1</p> <p>.2</p> <p>.3</p> <p>.4</p>	<p>Post legible versions of the following documents on site:</p> <p>Health and Safety Plan.</p> <p>Sequence of work.</p> <p>Emergency procedures.</p> <p>Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.</p>

- .5 Notice of Project.
  - .6 Floor plans or site plans.
  - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
  - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
  - .9 Material Safety Data Sheets (MSDS).
  - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
  - .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
  - .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.
- 1.17 Meetings
- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
- 1.18. Correction of Non-Compliance
- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
  - .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
  - .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/ subcontractors will be responsible for any costs arising from such a "stop work order".

**END OF SECTION**

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**PART 1 - GENERAL**

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| <b>1.1 Environmental Factors</b> <hr/>      | .1 | Ensure that operations meet all applicable environmental regulations and standards.                                     |
|   | .2 | Ensure no storm water runoff from the site of a deleterious nature is released into any storm sewers or water courses.  |
| <b>1.2 Disposal of Wastes</b> <hr/>         | .1 | Do not bury rubbish on site.  |
| <b>1.3 Fires</b> <hr/>                      | .1 | Fires and burning on site is not permitted.   |
| <b>1.4 Work Adjacent to Waterways</b> <hr/> | .1 | Do not operate construction equipment in waterways.   |
|   | .2 | Do not dump any waste material or debris in waterways.  |
| <b>1.5 Pollution Control</b> <hr/>          | .1 | Ensure all equipment is in proper working order.  |
|   | .2 | Control emissions from equipment to local authorities' emission requirements.   |
|   | .3 | Spill kits and containment materials must be maintained on-site and ready for deployment in case of spills.             |
|   | .1 | Spills kits are to contain sufficient quantities of absorbent material on site in close proximity to working machinery. |
|   | .2 | During the work, there is to be trained and qualified personnel on site that ready to deploy spill kits when necessary. |

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1.6 Submittals

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit an Environmental Emergency Response Plan including spill response plan.

PART 2 - EXECUTION

2.1 Work Procedures

- .1 Prior to the start of the work, the Environmental Response Plan is to be submitted to the Departmental Representative as note in Section 01 33 00.
- .2 Work on site will be conducted in accordance with the plans and specifications, the Environmental Response Plan and all other applicable regulations.

END OF SECTION

## PART 1 - GENERAL

1.1	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 35 43 – Environmental Procedures.
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1.2	Submittals	.1	Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
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1.3	Installation and Removal	.1	Provide temporary utilities controls and trailers necessary in order to execute work expeditiously.
		.2	Remove from site all such work after use.
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1.4	Dewatering	.1	Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
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1.5	Water Supply	.1	Potable water for construction use will not be provided by PWGSC.
		.2	Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
<hr/>			
1.6	Temporary Communication Facilities	.1	Provide and pay for temporary telephone, fax, data hook up, lines, equipment necessary for own use.
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1.7	Fire Protection	.1	Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
		.2	Burning rubbish and construction waste materials is not permitted on site.
<hr/>			
1.8	Sanitary Facilities	.1	Provide, pay, and maintain for sanitary facilities for the duration of the work.

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PART 2 - EXECUTION

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| 2.1 Temporary<br>Erosion and<br>Sedimentation<br>Control | .1 | Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction. |
|  | .2 | Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.   |
|  | .3 | Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.   |

END OF SECTION

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PART 1 - GENERAL

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|-----|------------------------|----|--|
| 1.1 | Waste Management Goals | .1 | Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals. |
|     |                        | .2 | Accomplish maximum control of solid construction waste.  |
|     |                        | .3 | Preserve environment and prevent pollution and environment damage.   |
| 1.2 | Related Sections       | .1 | Section 03 30 00 – Cast in place Concrete.   |
|     |                        | .2 | Section 31 32 19.01 – Geotextiles  |
|     |                        | .3 | Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type  |
|     |                        | .4 | Section 33 31 13 – Public Sanitary Utility Sewerage Piping   |
|     |                        | .5 | Section 33 34 00 – Sanitary Utility Sewerage Force Mains   |
|     |                        | .6 | Section 33 36 01 – Utility Septic Tanks and Wastewater Treatment Systems   |
|     |                        | .7 | Section 33 36 33 – Utility Drainage Field  |
| 1.3 | Definitions            | .1 | Inert Fill: inert waste – exclusively asphalt and concrete.  |
|     |                        | .2 | Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste         |
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- material into material categories from other types of waste at point of generation.
- .3 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
  - .4 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
  - .5 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
  - .6 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
    - .1 Salvaging reusable materials from re-modeling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
    - .2 Returning reusable items including pallets or unused products to vendors.
  - .7 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
  - .8 Separate Condition: refers to waste sorted into individual types.
  - .9 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
  - .10 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
  - .11 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (schedule A).

1.4 Documents

- .1 Maintain at job site, one copy of following documents:
  - .1 Waste Audit
  - .2 Waste Reduction Workplan
  - .3 Material Source Separation Plan.
  - .4 Schedules A & B completed for project

1.5 Submittals

- .1 Submittals in accordance with Section 01 33 00 – Shop Drawing, Product Data and Samples.
- .2 Prepare and submit following prior to project start up:
  - .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
  - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
  - .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.

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|--|---|---|
| <p><u>1.6 Waste Audit (WA)</u></p>               | <p>.1<br/>.2<br/>.3</p>   | <p>Conduct WA prior to project start-up.</p> <p>Prepare WA: Schedule A.</p> <p>Record, on WA – Schedule A, extent to which materials or products used consist of recycled or reused materials or products.</p>  |
| <p><u>1.7 Waste Reduction Workplan (WRW)</u></p> | <p>.1<br/>.2<br/>.3<br/>.4<br/>.5<br/>.6<br/>.7<br/>.8<br/>.9<br/>.3<br/>.4<br/>.5<br/>.6<br/>.7<br/>.8</p> | <p>Prepare WRW prior to project start-up.</p> <p>WRW should include but not limited to:</p> <ul style="list-style-type: none"> <li>.1 Destination of materials listed.</li> <li>.2 Deconstruction/disassembly techniques and sequencing.</li> <li>.3 Schedule for deconstruction/disassembly.</li> <li>.4 Location.</li> <li>.5 Security.</li> <li>.6 Protection.</li> <li>.7 Clear labelling of storage areas.</li> <li>.8 Details on materials handling and removal procedures.</li> <li>.9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.</li> </ul> <p>Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.</p> <p>Describe management of waste.</p> <p>Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.</p> <p>Post WRW or summary where workers at site are able to review content.</p> <p>Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.</p> <p>Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.</p> |

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| <p>1.8 <u>Materials Source Separation Program (MSSP)</u></p> | <ul style="list-style-type: none"> <li>.1 Prepare MSSP and have ready for use prior to project start-up.</li> <li>.2 Implement MSSP for waste generated on project in compliance with approved methods as reviewed by Departmental Representative.</li> <li>.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.</li> <li>.4 Provide containers to deposit reusable and recyclable materials.</li> <li>.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.</li> <li>.6 Locate separated material[s] in area[s] which minimize material damage.</li> <li>.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.                             <ul style="list-style-type: none"> <li>.1 Transport to approved and authorized recycling facility.</li> </ul> </li> </ul>          |
| <p>1.9 <u>Storage, Handling And Protection</u></p>           | <ul style="list-style-type: none"> <li>.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.</li> <li>.2 Unless specified otherwise, materials for removal become Contractor's property.</li> <li>.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.</li> <li>.4 Protect structural components not removed for demolition from movement or damage.</li> <li>.5 Protect surface drainage, mechanical and electrical from damage and blockage.</li> <li>.6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.                             <ul style="list-style-type: none"> <li>.1 On-site source separation is recommended.</li> <li>.2 Provide waybills for separated materials.</li> </ul> </li> </ul> |

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|---------------------------------|----|--|
| 1.10 Disposal Of Wastes         | .1 | Do not bury rubbish or waste materials.  |
|                                 | .2 | Do not dispose of waste into waterways, storm, or sanitary sewers.   |
|                                 | .3 | Keep records of construction waste including:  |
|                                 | .1 | Number and size of bins.   |
|                                 | .2 | Waste type of each bin.  |
|                                 | .3 | Total tonnage generated.   |
|                                 | .4 | Tonnage reused or recycled.  |
|                                 | .5 | Reused or recycled waste destination.  |
|                                 | .4 | Remove materials from deconstruction as deconstruction/ disassembly Work progresses.   |
|                                 | .5 | Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit. |
| 1.11 Use Of Site And Facilities | .1 | Execute work with least possible interference or disturbance to normal use of premises.  |
|                                 | .2 | Maintain security measures established by existing facility.   |
| 1.12 Scheduling                 | .1 | Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.  |
| 1.13 Application                | .1 | Do Work in compliance with WRW.  |
|                                 | .2 | Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.                               |
| 1.14 Cleaning                   | .1 | Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.                                  |
|                                 | .2 | Clean-up work area as work progresses.   |
|                                 | .3 | Source separate materials to be reused/ recycled into specified sort areas.  |

1.15 Diversion of Materials

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
  - .1 Mark containers or stockpile areas.
  - .2 Provide instruction on disposal practices.
- .2 On-site sale of materials IS NOT permitted.
- .3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

- .4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		



1.17 Waste Reduction .1 Schedule B.  
 Workplan

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected Actual	(5) Recycled Amount (unit) Project Actual	(6) Material Destination
Wood and Plastics Material Description					
Chutes					
Warped Pallet Forms					
Plastic Packaging					
Cardboard Packaging					
Wood					
Metal					
Other					

END OF SECTION

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PART 1 - GENERAL

- |       |                             |    |   |
|-------|-----------------------------|----|---|
| 1.1   | Related Requirements        | .1 | 32 32 13.13 – Packaged Sewage Lift, Wet Well Type   |
|       |                             | .2 | 32 92 16.16 – Hydraulic Seeding   |
|       |                             | .3 | 33 36 01 – Utility Septic Tanks and Wastewater Treatment Systems.   |
|       |                             | .4 | 33 36 33 – Utility Drainage Field.  |
| <hr/> |                             |    |   |
| 1.2   | Administrative Requirements | .1 | Pre-warranty Meeting:   |
|       |                             | .1 | Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative to:  |
|       |                             | .1 | Verify Project requirements.  |
|       |                             | .2 | Review manufacturer's installation instructions and warranty requirements.  |
|       |                             | .2 | Departmental Representative to establish communication procedures for:  |
|       |                             | .1 | Notifying construction warranty defects.  |
|       |                             | .2 | Determine priorities for type of defects.   |
|       |                             | .3 | Determine reasonable response time.   |
|       |                             | .3 | Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action. |
|       |                             | .4 | Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.                    |

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|--|---|---|
| <p>1.4 Action and Informational Submittals</p> <hr style="width: 200px; margin-left: 0;"/> | <p>.1<br/>.2<br/>.3<br/>.4</p>  | <p>Provide submittals in accordance with Section 01 33 00 Submittal Procedures.</p> <p>Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.</p> <p>Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.</p> <p>Provide evidence, if requested, for type, source and quality of products supplied.</p>  |
| <p>1.5 Format</p> <hr style="width: 200px; margin-left: 0;"/>                              | <p>.1<br/>.2<br/>.3<br/>.1<br/>.4<br/>.5<br/>.6<br/>.7<br/>.8<br/>.1<br/>.9</p> | <p>Organize data as instructional manual.</p> <p>Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.</p> <p>When multiple binders are used correlate data into related consistent groupings.</p> <p>.1 Identify contents of each binder on spine.</p> <p>Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.</p> <p>Arrange content by systems (i.e. utilities, controls) under Section numbers and sequence of Table of Contents.</p> <p>Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.</p> <p>Text: manufacturer's printed data, or typewritten data.</p> <p>Drawings: provide with reinforced punched binder tab.</p> <p>.1 Bind in with text; fold larger drawings to size of text pages.</p> <p>Provide scaled CAD files in dxf and/or dwg format on CD.</p> |

- |     |                                     |    |  |
|-----|-------------------------------------|----|--|
| 1.6 | Contents – Project Record Documents | .1 | Table of Contents for Each Volume: provide title of project;   |
|     |                                     | .1 | Date of submission; names.   |
|     |                                     | .2 | Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.  |
|     |                                     | .3 | Schedule of products and systems, indexed to content of volume.  |
|     |                                     | .2 | For each product or system:  |
|     |                                     | .1 | List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.                 |
|     |                                     | .3 | Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information. |
|     |                                     | .4 | Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.              |
|     |                                     | .5 | Typewritten Text: as required to supplement product data.  |
|     |                                     | .1 | Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.  |
| 1.7 | As Built Documents And Samples      | .1 | Maintain, in addition to requirements in General Conditions, at site for the Departmental Representative one record copy of:                           |
|     |                                     | .1 | Contract Drawings.   |
|     |                                     | .2 | Specifications.  |
|     |                                     | .3 | Addenda.   |
|     |                                     | .4 | Change Orders and other modifications to Contract.   |
|     |                                     | .5 | Reviewed shop drawings, product data, and samples.   |
|     |                                     | .6 | Field test records.  |
|     |                                     | .7 | Inspection certificates.   |
|     |                                     | .8 | Manufacturer's certificates.   |

- 
- .2 Store record documents and samples in field office apart from documents used for construction.
    - .1 Provide files, racks, and secure storage.
  - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
    - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
  - .4 Maintain record documents in clean, dry and legible condition.
    - .1 Do not use record documents for construction purposes.
  - .5 Keep record documents and samples available for inspection by Departmental Representative.
- 1.8 Recording Information On Project Record Documents
- 
- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
  - .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
  - .3 Record information concurrently with construction progress.
    - .1 Do not conceal Work until required information is recorded.
  - .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
    - .1 Measured depths of elements of foundation in relation to geodetic datum.
    - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
    - .3 Field changes of dimension and detail.
    - .4 Changes made by change orders.
    - .5 Details not on original Contract Drawings.
    - .6 References to related shop drawings and modifications.

- .5 Specifications: mark each item to record actual construction, including:
    - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
    - .2 Changes made by Addenda and change orders.
  - .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.
  - .7 Provide digital photos for site records.
  - .8 Verify location of all water system components on Port Hardy airport property on the as-built drawing.
- 1.9 Final Survey
- 
- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non conformance with Contract Documents.
- 1.10 Equipment And Systems
- 
- .1 For each item of equipment and each system include description of unit or system, and component parts.
    - .1 Give function, normal operation characteristics and limiting conditions.
    - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
  - .2 Maintenance Requirements: include routine procedures and guide for trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
  - .3 Include manufacturer's printed operation and maintenance instructions.
  - .4 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
  - .5 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

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	. 6		Additional requirements: as specified in individual specification sections.
1.11 Maintenance Materials	.1		Spare Parts:
		.1	Provide spare parts, in quantities specified in individual specification sections.
		.2	Provide items of same manufacture and quality as items in Work.
		.3	Deliver to site; place and store.
		.4	Receive and catalogue items.
		.1	Submit inventory listing to Departmental Representative.
		.2	Include approved listings in Maintenance Manual.
		.5	Obtain receipt for delivered products and submit prior to final payment.
	.2		Special Tools:
		.1	Provide special tools, in quantities specified in individual specification section.
		.2	Provide items with tags identifying their associated function and equipment.
		.3	Deliver to site; place and store.
		.4	Receive and catalogue items.
		.1	Submit inventory listing to Departmental Representative.
		.2	Include approved listings in Maintenance Manual.
1.12 Delivery, Storage And Handling	.1		Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
	.2		Store in original and undamaged condition with manufacturer's seal and labels intact.
	.3		Store components subject to damage from weather in weatherproof enclosures.
	.4		Store paints and freezable materials in a heated and ventilated room.
	.5		Remove and replace damaged products at own expense and for

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review by Departmental Representative.

1.13 Warranties And Bonds

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative.
- .3 Warranty management plan to include required actions and documents to assure that the Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to the Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 12 month warranty inspection, measured from time of acceptance, by Departmental Representative.

- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
    - .1 Name of item.
    - .2 Model and serial numbers.
    - .3 Location where installed.
    - .4 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
    - .7 Cross-reference to warranty certificates as applicable.
    - .8 Starting point and duration of warranty period.
    - .9 Summary of maintenance procedures required to continue warranty in force.
    - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
    - .11 Organization, names and phone numbers of persons to call for warranty service.
    - .12 Typical response time and repair time expected for various warranted equipment.

- .3 Contractor's plans for attendance at 12 month post-construction warranty inspections.
- .4 Procedure and status of tagging of equipment covered by extended warranties.
- .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/ or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.14 Warranty Tags

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- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction Contractor.

PART 2 - PRODUCTS

2.1 Not Used .1 Not used.

PART 3 - EXECUTION

3.1 Not Used .1 Not used.

END OF SECTION

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**PART 1 - GENERAL**

- |            |                                    |           |   |
|------------|------------------------------------|-----------|---|
| <b>1.1</b> | <b>Related Requirements</b>        | <b>.1</b> | Refer to sections 32 32 13.13 and 33 36 01 regarding system tests that are also to be used for demonstration purposes.  |
| <hr/>      |                                    |           |   |
| <b>1.2</b> | <b>Administrative Requirements</b> | <b>.1</b> | Demonstrate operation and maintenance of equipment and systems to Departmental Representative two weeks prior to date of final inspection.  |
|            |                                    | <b>.2</b> | Departmental Representative to provide list of personnel to receive instructions, and co-ordinate their attendance at agreed upon times.  |
|            |                                    | <b>.3</b> | Preparation: <ul style="list-style-type: none"><li><b>.1</b> Verify conditions for demonstration and instructions comply with requirements.</li><li><b>.2</b> Verify designated personnel are present.</li><li><b>.3</b> Ensure equipment has been inspected and put into operation in accordance with Sections 32 32 13.13 and 33 36 01.</li><li><b>.4</b> Ensure testing, adjusting, and balancing has been performed in accordance with Sections 32 32 13.13 and 33 36 01 and equipment and systems are fully operational.</li></ul>   |
|            |                                    | <b>.4</b> | Demonstration and Instructions: <ul style="list-style-type: none"><li><b>.1</b> Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.</li><li><b>.2</b> Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.</li><li><b>.3</b> Review contents of manual in detail to explain aspects of operation and maintenance.</li><li><b>.4</b> Prepare and insert additional data in operations and maintenance manuals when needed during instructions.</li></ul> |

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- .5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows. :
    - .1 Section 32 32 13.13 Packaged Sewage Lift, Wet Well Type: 2 hours of instruction.
    - .2 Section 33 36 01 Utility Septic Tanks and Wastewater Treatment Systems: 2 hours of instruction.
- 
- 1.3 Action and Informational Submittals
    - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
    - .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
    - .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
    - .4 Give time and date of each demonstration, with list of persons present.
    - .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

END OF SECTION

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**PART 1 - GENERAL**

1.1	Related Sections	.1	Section 31 00 99 – Earthworks for Minor Works.
		.2	Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type
		.3	Section 33 36 01 – Utility Septic Tanks and Wastewater Treatment Systems
<hr/>			
1.2	Price and Payment Procedures	.1	Cast-in-place concrete will be measured incidental to other items that it forms a component of per the requirements of the Contract Drawings.
<hr/>			
1.3	References	.1	CAN/ CSA-A23.1 Concrete Materials and Methods of Concrete Construction (Including Notes and Appendices in the Standard)
		.2	CAN/ CSA-A23.2 Test methods and standard practices for Concrete
		.3	CAN/ CSA-S269.3 Concrete Formwork
		.4	CAN/ CSA A3000 Supplementary Cementing Materials, Building Materials and Products
		.5	ACI 305R Hot weather concreting
		.6	ACI 306R Cold weather concreting
		.7	ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
		.8	ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
		.9	ASTM C494 Standard Specification for Chemical Admixtures for Concrete
		.10	Additional material and testing standards listed in CAN/ CSA-A23.1.
<hr/>			
1.4	Submittals	.1	Submit concrete mix designs of any mix designed by the Contractor to the Departmental Representative for review 14 days prior to placement. Concrete mix design submittals shall include the mass in kilograms of fine aggregate, coarse aggregate, cement, fly ash, silica fume and water in each cubic metre of concrete. Concrete mix design submittals shall specify the properties of the concrete.
		.2	Submit copies of all test results to the Departmental Representative for review. Submission of test results will not relieve the Contractor from his obligation to interpret the test results and make necessary corrections or adjustments to his construction procedures or mix designs..
		3	At least four weeks prior to commencing work of this section,

			inform the Departmental Representative of proposed source of aggregates and provide access for sampling.
		.4	Submit a letter of assurance that the proposed aggregate source will not produce concrete that will be compromised by deleterious effects from alkali-aggregate reaction.
1.5	Quality Control Submittals	.1	Provide proof of certification that plant, equipment, and materials including aggregates to be used in concrete comply with requirements of CAN/ CSA-A23.1.
		.2	Submit test results based on trial mixes showing that concrete mix designs will produce concrete meeting the requirements of this section and that strength will comply with CAN/ CSA-A23.1.
		.3	Submit manufacturer's datasheets and printed instructions for joint sealant and primer proposed for use in the Work.
1.6	Quality Assurance	.1	Perform all concrete Work in accordance with the requirements of CAN/ CSA A23.1.
		.2	Concrete testing shall be performed by the Contractor, and results submitted to the Departmental Representative.
 PART 2 - PRODUCTS			
2.1	Concrete Materials	.1	Portland Cement and Supplementary Cementing Material : Type GU Portland cement to CAN/ CSA-A3000
		.2	Water: to CAN/ CSA-A23.1.
		.3	Aggregates: to CAN/ CSA-A23.1, normal density.
		.4	Air Entraining Admixtures: to ASTM C260.
		.5	Chemical Admixtures: to ASTM C494. Departmental Representative to approve type and use of accelerating or set-retarding admixtures during cold and hot weather placing.
		.6	Curing Compound: to CSA A23.1 and ASTM C309
2.2	Formwork Materials	.1	Formwork materials shall meet the requirements of CAN/ CSA-S269.3 and this section.
		.2	Contact surfaces or lining of formwork shall be suitably smooth to provide finished concrete surfaces meeting the requirements of this section.
		.3	Form Ties: threaded internal disconnecting type, leaving no holes larger than 1 in. diameter in concrete surface.
		.4	Form Release Agent: non-staining chemically active release agent, compatible with form material which will prevent adherence of concrete to forms.

- 2.3 Concrete Mixes
- .1 Select concrete mix proportions in accordance with CAN/ CSA-A23.1 to give the following properties for all cast-in-place concrete unless specified otherwise on design Drawings:
    - .1 Minimum Compressive Strength at 28 Days: 35 MPa.
    - .3 Maximum Water/Cementing Materials Ratio: 0.40.
    - .4 Exposure Class: C-1.
    - .5 Nominal Maximum Size of Coarse Aggregate: 20 mm.
    - .6 Slump at Time and Point of Discharge: 130 mm ± 25 mm.
    - .7 Air Content: 5% to 8%.
  - .2 Do not change concrete mix without prior approval of the Departmental Representative. Should change in material source be proposed, new mix design to be approved by the Departmental Representative.

- 2.4 Concrete Production
- .1 Measure, batch and mix concrete in accordance with CAN/ CSA-A23.1.
  - .2 Before unloading concrete at the Site, furnish the Departmental Representative with a delivery ticket for each batch of concrete in accordance with CAN/ CSA-A23.1.

PART 3 - EXECUTION

- 3.1 General
- .1 Prior to placing concrete, ensure that all reinforcing and other items to be embedded in concrete are in place, properly oriented, located, and secured. Verify that concrete may be placed to the lines and elevations shown on the Drawings with all required clearances and cover for reinforcement. Ensure that forms are clean and absolutely all debris has been removed.
  - .2 Obtain the Departmental Representative's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.
  - .3 Prior to placing concrete, obtain the Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
  - .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and any Contractor's test samples taken.

- 3.2 Formwork
- .1 Construct and erect formwork in accordance with CAN/ CSA-S269.3.
  - .2 Assemble forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/ CSA-A23.1.
  - .3 Align form joints and make watertight. Use minimum number of

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			form joints.
		.4	Clean formwork in accordance with CAN/ CSA-A23.1 before placing concrete.
3.3	Preparation	.1	Set sleeves, anchor bolts and other inserts as indicated or specified elsewhere. Sleeves and openings greater than 100 mm and not indicated on structural Drawings must be approved by the Departmental Representative.
		.2	Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Departmental Representative before placing of concrete.
3.4	Placing of Concrete – General	.1	Handle, deposit and consolidate concrete in accordance with CAN/ CSA-A23.1 and ACI A309R. Take care not to disturb forms or reinforcing steel when depositing and consolidating concrete.
		.2	Ensure that spare internal vibrators or external form vibrators are on hand during placing of concrete.
		.3	Unless specified otherwise, where fresh concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CAN/ CSA-A23.1.
3.5	Construction Joints	.1	Make construction joints in accordance with CAN/ CSA-A23.1.
		.2	Locate construction joints as indicated on the Drawings or as approved by the Departmental Representative. Construction joints not indicated on the Drawings will not be permitted without the prior authorization of the Departmental Representative.
3.6	Finishing Unformed Surfaces	.1	Top surfaces of concrete which will ultimately receive additional concrete: <ul style="list-style-type: none"> <li>.1 Screed the surface across the grade strips or forms so that the resulting surface will have no irregularities greater than the maximum size aggregate.</li> <li>.2 Roughen the surface with 6 mm amplitude.</li> <li>.3 Prior to placing additional concrete, clean the surface of: laitance, dirt, excess water, and other deleterious material. Do not use hydro-milling until sufficient time has elapsed to prevent loosening of the top aggregate.</li> </ul>
		.2	Top Surface of Exposed Concrete: <ul style="list-style-type: none"> <li>.1 Initial Finishing: immediately after placing concrete, screed the surface to the indicated grade and Work the surface with a bull float, or with a darby and highway straight edge, in accordance</li> </ul>

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			with CAN/ CSA-A23.1. Complete initial finishing before any bleeding or free water is present on the concrete surface.
		.2	Begin final finishing operations after the bleed water has disappeared and the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. Do not add water to facilitate finishing. Carry out final finishing operations in accordance with CAN/ CSA-A23.1.
		.3	Unless noted otherwise, exterior surfaces shall receive a light broom finish, with broom striations approximately 2 mm deep.
		.3	Finished surfaces shall conform to the slopes specified on the Drawings.
3.7	Finishing Formed Surfaces	.1	Finish formed surfaces in accordance with CAN/CSA-A23.1 and as specified below.
		.2	Formed surfaces which may ultimately serve as forms for additional concrete pour or which will remain unexposed:
		.1	The surface may contain shear keys, reinforcing steel, anchor bolts, or other embedments as indicated on the Drawings.
		.2	Repair honeycomb concrete and fill form-tie holes. Remove fins and ridges from concrete surfaces.
		.3	Clean the surface of laitance, dirt, excess water, and other deleterious material prior to applying waterproofing treatment or placing additional concrete.
3.8	Curing And Protection	.1	Cure and protect concrete in accordance with CAN/ CSA-A23.1 and as specified below.
		.2	Cure topping concrete by the application of wetted burlap immediately after completion of finishing operations. Maintain burlap in a saturated condition using soaker hoses wrapped in burlap and installed on top of the deck surface. When the daily mean ambient temperature is above 5 deg. C, curing shall be continuous for a minimum of seven days or for the time necessary to attain 70% of the specified 28 day compressive strength.
		.3	When the air temperature is at or above 27 deg. C, or when there is a probability of it rising to 27 deg. C during the placing period (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 305R - Hot Weather Concreting.
		.4	When the air temperature is at or below 5 deg. C, or when there is a probability of it falling below 5 deg. C within 24 hours of placing (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 306R - Cold Weather Concreting.

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- 3.9 Tolerances
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- .1 Tolerances for concrete Work as built shall conform to CAN/ CSA-A23.1 unless indicated otherwise.
  - .2 Finish tolerances for concrete topping shall meet the requirements for the conventional (non-slip) Class B surface of CAN/ CSA-A23.1 Table 16.
  - .3 The flatness of the topping surface will be determined by the straightedge method as outlined in CAN/ CSA-A23.1.
- 3.10 Field Quality Control
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- .1 Inspection and testing of concrete and concrete materials shall be carried out by a Testing Laboratory approved by Departmental Representative, engaged and paid for by the Contractor, in accordance with CAN/ CSA A23.1.A "test" shall consist of a slump test, an air entrainment test, and samples collected for compression testing.
  - .2 Pumped concrete shall be sampled both at the truck discharge and at the point of final placement to determine if any changes in the slump, air content or other significant mix characteristics occur. The concrete at the forms shall meet all the requirements of this section.
  - .3 Additional test cylinders shall be taken during cold weather concreting. Cure cylinders on job Site under same conditions as concrete which they represent.
  - .4 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

**END OF SECTION**

## PART 1 - GENERAL

## 1.1 References

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C88, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
  - .2 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregate.
  - .3 ASTM C117, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .4 ASTM D1557, Specification for Test Methods for Aggregate Mixtures using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.
  - .5 ASTM D698, Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures using 2.49 kg Rammer and 304.8 mm Drop.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA A23.1/ A23.2 09, Concrete Materials and Methods of Concrete Construction.

## 1.2 Regulations

- .1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.
- .2 Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill or fill materials proposed for use.
- .3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative so that compaction tests can be carried out by designated testing agency.
- .5 Before commencing work, conduct, with the Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and

				paving, survey bench marks and monuments which may be affected by work.
1.3	Tests and Inspections	.1		Testing of materials and compaction of backfill and fill will be carried out by a certified testing firm, retained by the Contractor and approved by the Departmental Representative.
1.4	Buried Services	.1		Before commencing work, verify the location of all buried services on and adjacent to the site using ground penetrating radar.
		.2		Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.
		.3		Remove obsolete buried services within 2 m of foundations. Cap cut offs.
1.5	Protection	.1		Protect excavations from freezing.
		.2		Keep excavations clean, free of standing water, and loose soil.
		.3		Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.
		.4		Protect natural and manmade features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
		.5		Protect buried services that are required to remain undisturbed.
PART 2 - PRODUCTS				
2.1	Materials	.1		Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.

- .2 All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following sieve must have one or more fractured faces. Determination of the Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.
- .3 Native material to be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material for purposes of payment if it is approved by the Contract Administrator. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.
- .4 Granular Pipe Bedding and Surround Material  
Crushed or graded gravels: to conform to following gradation:

Sieve Designation	Percent Passing	
	Type 1*	Type*2
25.0mm	100	100
19.0mm	90 - 100	90 - 100
12.5mm	65 - 85	70 - 100
09.5mm	50 - 75	--- ---
4.75mm	25 - 50	40 - 70
2.36mm	10 - 35	25 - 52
1.18mm	6 - 26	15 - 38
0.600mm	3 - 17	6 - 27
0.300mm	--- ---	3 - 20
0.075mm	0 - 5	0 - 8

\*Type 1: standard gradation

\*Type 2: to be used only in dry trench conditions and with Departmental Representative's prior approval.

- .5 Top Soil for seeded areas: mixture of articulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture: The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
  - .2 Contain no toxic elements or growth inhibiting materials.
  - .3 Finished surface free from:
    - .1 Debris and stones over 50 mm diameter.
    - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
  - .4 Consistence: friable when moist.

PART 3 - EXECUTION

3.1 Site Preparation

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 Clearing and Grubbing

- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
- .2 Remove stumps and tree roots below footings, slabs, and paving, and to not less than 200 mm below finished grade elsewhere.
- .3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

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### 3.3 Excavation

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- .1 Topsoil stripping
  - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
  - .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
  - .3 Dispose of topsoil as directed by the Departmental Representative.
- .2 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify the Departmental Representative when excavations are complete. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .3 Excavate trenches to provide uniform continuous bearing and support for 100 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 300 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .4 Excavate for slabs and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

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| <p>3.4 Backfilling</p> <hr/>            | <ul style="list-style-type: none"> <li>.1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by the Departmental Representative.</li> <li>.2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.</li> <li>.3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.</li> <li>.4 Compaction: place backfill to underside of required sub-base and base layers, and compact to following Modified Proctor densities in compliance with ASTM D1557. (All densities in compliance with ASTM D1557).             <ul style="list-style-type: none"> <li>.1 Boulevards and easements to minimum 90%</li> <li>.2 Roads, driveways, shoulders, re-shaped ditches and sidewalks to minimum 95%.</li> <li>.3 Use caution in pipe zone to ensure no damage to pipe.</li> </ul> </li> <li>.5 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.</li> <li>.6 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.</li> <li>.7 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.</li> </ul> |
| <p>3.5 Contaminated Materials</p> <hr/> | <ul style="list-style-type: none"> <li>.1 If contaminated materials are detected during excavation operations, immediately notify the Departmental Representative. Any contaminated materials to be disposed of using methods approved by the Departmental Representative.</li> </ul>  |
| <p>3.6 Grading</p> <hr/>                | <ul style="list-style-type: none"> <li>.1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Departmental Representative. Grade to be gradual between finished spot elevations shown on drawings.</li> </ul>  |

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| <u>3.7 Topsoil Placement</u>        | .1 | Place a minimum of 150 mm of top soil under all areas where grass seeding is indicated on the contract drawings.                                  |
|                                     | .2 | The Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading. |
| <br><u>3.8 Shortage and Surplus</u> | .1 | Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.                         |
|                                     | .2 | Dispose of surplus material off site.   |

END OF SECTION

## PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation of polymeric geotextiles used in revetments, breakwaters, retaining wall structures, filtration, drainage structures, roadbeds and railroad beds purpose of which is to:
		.1	Separate and prevent mixing of granular materials of different grading.
		.2	Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 74 21 – Waste Management and Disposal.
		.3	Section 31 00 99 – Earthworks for Minor Works
		.4	Section 33 36 33 – Utility Drainage Field.
1.3	Measurement Procedures	.1	Measure geotextiles incidental to the works they are a component of.
1.4	References	.1	American Society for Testing and Materials International, (ASTM):
		.1	ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
		.2	ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
		.3	ASTM D4716-08(2013), Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
		.4	ASTM D4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
		.2	Canadian General Standards Board (CGSB):
		.1	CAN/CGSB-4.2 No. 11.2-M89(April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
		.2	CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
		.1	No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
		.2	No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
		.3	No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under

			No Compressive Load
		.4	No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles
		.5	No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size
	.3		Canadian Standards Association (CSA International):
		.1	CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
		.2	CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
	.4		Ontario Provincial Standard Specifications (OPSS):
		.1	OPSS 1860-[March 1998], Material Specification for Geotextiles.
	.5		British Columbia Ministry of Health – British Columbia Onsite Sewage Association:
		.1	Sewerage System Standard Practice Manual – Version 2, 21 September, 2007.
1.5	Submittals	.1	Submit to Departmental Representative 3 copies of mill test data and certificate at least 4 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.
1.6	Delivery, Storage and Handling	.1	During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.
1.7	Waste Management and Disposal	.1	Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
		.2	Remove from site and dispose of packaging materials at appropriate recycling facilities.

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PART 2 - PRODUCTS

- 2.1 Material
- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls:
    - .1 Width: 2 m minimum.
    - .2 Length: 200 m minimum.
    - .3 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
  - .2 Physical properties:
    - .1 Thickness: to CAN/CGSB-148.1, No.3, minimum 1.2 mm.
    - .2 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 155 g/m<sup>2</sup>.
    - .3 Grab tensile strength and elongation: to ASTM D4632.
      - .1 Breaking force: minimum 35 lb, wet condition.
      - .2 Elongation at future: minimum 50%.
    - .4 Puncture; to ASTM D4833: 10 lbs minimum.
    - .6 Trapezoidal tear; to ASTM D4533: 11 lbs minimum.
  - .3 Hydraulic properties:
    - .1 Apparent opening size (AOS): to ASTM D4751, US Sive # 20 minimum and 70 maximum.
    - .2 Permittivity: to ASTM D4491, 100 gal/min/sq ft minimum.
  - .4 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to CAN/CSA G164

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PART 3 - EXECUTION

3.1 Installation

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- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 h of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 00 99 – Earthworks for Minor Works.

3.2 Cleaning

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- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.3 Protection

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- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

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**PART 1 - GENERAL**

1.1	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 74 21 – Waste Management and Disposal.
		.3	Section 01 78 00 – Closeout Submittals
		.4	Section 03 30 00 – Cast-in-Place Concrete
		.5	Section 31 00 99 – Earthworks for Minor Works
		.6	Section 32 36 01 – Utility Septic Tanks and Wastewater Treatment Systems.
<hr/>			
1.2	Measurement Procedures	.1	Measure packaged sewage lift stations in number of lift stations supplied and installed including stripping, excavating, bedding, backfilling, testing and commissioning.
<hr/>			
1.3	References	.1	American National Standards Institute (ANSI)/American Water Works Association (AWWA):
		.1	ANSI/AWWA C500-09, Metal-Seated Gate Valves for Water Supply Service.
		.2	ANSI/AWWA C504-00, Rubber-Seated Butterfly Valves.
		.3	ANSI/AWWA C508-09, Swing-Check Valves for Waterworks Service, 2 inch (50 mm) through 24 inch (600 mm) NPS.
		.2	American Society for Testing and Materials International, (ASTM):
		.1	ASTM C 478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
		.3	Canadian Standards Association (CSA International):
		.1	CAN/CSA-A257 Series-[M92(R1998)], Standards for Concrete Pipe.
		.2	CSA-B70-[02], Cast Iron Soil Pipe, Fittings and Means of Joining.
		.4	British Columbia Ministry of Health – British Columbia Onsite Sewage Association:
		.1	Sewerage System Standard Practice Manual – Version 2, 21 September, 2007.
<hr/>			
1.4	System Description	.1	Reinforced concrete enclosure or structural plastic or composite enclosure. Pumping system to be factory assembled and disassembled for shipment with mating components clearly identified. Principal items of equipment to include 2 identical submersible sewage pumping units, all internal piping and valves, liquid level controls, lifting chains, guide bars, debris screen, vents complete with screens, cover, electrical wiring, control panel with circuit breakers and motor starters.

- .2 Equipment and installation to include following:
  - .1 Excavation for sewage lift station.
  - .2 Preparation of subgrade.
  - .3 Connection of power to control panel as indicated.
  - .4 Connections to sanitary sewers and force mains.
  - .5 Supply and installation of packaged sewage lift station in accordance with manufacturer's instructions.
- .3 Wet well sewage lift station.
  - .1 Fully automatic, consisting of duplex submersible pumps mounted on rail system. Control to be by series of liquid level bulbs.
  - .2 Pumps to alternate as lead pump on each cycle.
  - .3 Incorporate time delay relays in control circuits to allow continuation of pump for pre-set time after normal pump shut down signal is received.
  - .4 Operate both pumps when lag pump "on" water level is reached in wet well. Lag pump to shut off when water level drops to pump "off" water level.
  - .5 Locate control system in control station [mounted above lift station cover plate].
- 1.5 Shop Drawings
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit shop drawings for civil, structural, hydraulic, mechanical and electrical elements.
  - .3 Indicate individual components by manufacturer's model number and accompany with technical and performance characteristics.
- 1.6 Closeout Submittals
  - .1 Provide operation and maintenance data for sewage lift station for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2 Include in this information.
    - .1 Record drawings, wiring diagrams, electrical schematics of equipment as installed.
    - .2 Interconnections with numbers and wire sizes.
    - .3 Certified pump characteristic curves.
    - .4 Detailed operation and maintenance instructions.
    - .5 Spare parts list comprising a complete schedule clearly identified to facilitate re-ordering.

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| 1.7 | Waste Management and Disposal | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. |
|     |                               | .2 | Remove from site and dispose of packaging materials at appropriate recycling facilities.  |

PART 2 - PRODUCTS

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|-----|--------------------|----|---|
| 2.1 | Wet Well Structure | .1 | Structure : leak free, polyethylene or fibre reinforced plastic or cast-in-place reinforced concrete with access opening and designed for following forces: <ul style="list-style-type: none"> <li>.1 Dead load of station and components, dynamic and kinetic forces of rotating equipment.</li> <li>.2 Dead load from soil over structure, superimposed live load of 12 kN/m<sup>2</sup> or single wheel load of 54 kN over an area of 750 x 750 mm.</li> <li>.3 Hydrostatic uplift forces.</li> <li>.4 Horizontal earth loading and full hydrostatic pressure assuming water at ground elevation.</li> </ul> |
|     |                    | .2 | Waterproof exterior surfaces below grade.   |
|     |                    | .3 | Materials. <ul style="list-style-type: none"> <li>.1 Polyethylene tanks in accordance with Section 33 36 01 – Utility Septic Tanks and Wastewater Treatment Systems</li> </ul>  |
| 2.2 | Pumps              | .1 | Two vertical, single stage, bottom suction, non-clog, heavy duty, totally submersible centrifugal pumps, direct connected to motor by solid stainless steel shaft and fitted with thrust bearings.  |
|     |                    | .2 | Characteristics: <ul style="list-style-type: none"> <li>.1 Capacity: 2.5 L/s at 63.73 kPa head.</li> <li>.2 Total dynamic head: 6.5 m</li> <li>.3 Maximum static suction lift: 9.75 m.</li> <li>.4 Maximum speed: 1650 r/m</li> <li>.5 4/10 HP</li> </ul>   |
|     |                    | .3 | Volute casing: cast iron, minimum grade Class 30, close coupled.  |
|     |                    | .4 | Impeller: bronze, open or semi-open, in static and dynamic balance. All fasteners to be stainless steel.  |
|     |                    | .5 | Capable of passing 19 mm solid sphere.  |

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| <p>2.3 Pump Lifting System Material</p> <hr/> | <p>.1<br/>.2<br/>.3</p>                             | <p>Pumps to be complete with sliding guide and brackets, chains and quick leak-proof disconnect to discharge piping, all allowing for withdrawal of pumps.</p> <p>Provide galvanized lifting chain or stainless steel cable for each pump accessible from roof access hatches.</p> <p>Galvanized steel pipe to act as quick rails for pump.</p>   |
| <p>2.4 Submersible Motors</p> <hr/>           | <p>.1<br/>.2<br/>.3<br/>.4<br/>.5<br/>.6<br/>.7</p> | <p>Motors.</p> <p>.1 Single phase.</p> <p>.2 Capable of operating pump at any point on selected impeller curve without exceeding motor nominal rating.</p> <p>.3 Fully overload protected.</p> <p>.4 Assembly capable of operating continuously in air without overheating.</p> <p>.5 Complete with NEMA approved winding temperature sensor.</p> <p>.2 Motor speed: maximum 1800 r/min.</p> <p>.3 Motor enclosure and seal housing: corrosion resistant, completely watertight, cast iron.</p> <p>.4 Bearing: anti-friction type, greasable, with lubrication lines and fittings, minimum 50,000 hours, B-10 life.</p> <p>.5 Terminal box: watertight, with waterproof cable entry glands mounted at motor.</p> <p>.6 Shaft seals: double mechanical seals with tungsten/carbide faces.</p> <p>.7 Motor leads and power cords to be sealed and locked in place using strain bushings. All cables to be waterproof.</p> |
| <p>2.5 Pump Control System</p> <hr/>          | <p>.1<br/>.2<br/>.3</p>                             | <p>Liquid level switches: shock-proof mercury switches enclosed in leak-proof polypropylene body.</p> <p>Provide following independently adjustable control levels:</p> <p>.1 Lead pump start level.</p> <p>.2 Lead pump stop level</p> <p>.3 Lag pump start level.</p> <p>.4 Lag pump stop level</p> <p>.5 High water alarm</p> <p>.3 Lead pump and lag pump controls to include alternator relay to provide automatic pump alteration for each pumping cycle when pump sequence selection switch is on automatic.</p>   |
| <p>2.6 Piping and Valves</p> <hr/>            | <p>.1<br/>.2<br/>.3</p>                             | <p>Cast iron pipe, fittings and joints: to CSA-B70, minimum size [100] mm (PVC also acceptable).</p> <p>Butterfly valves: to ANSI/AWWA C504.</p> <p>Gate valves: solid wedge, Class 125, flanged, to ANSI/AWWA C500.</p>  |

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|   | .4  | Check valves: Class 125, swing check type, spring loaded lever, stainless steel shaft, to ANSI/AWWA C508.  |
| 2.7 Electrical and Control Panel Wiring | .1  | All components to be CSA approved.   |
|   | .2  | Electrical equipment in station to requirement for Hazardous Locations, Class 1, Group D, Division 2.  |
|   | .3  | Panel enclosure to NEMA 3 weather proof of fabricated steel suitably braced, double door equipped with locking device, suitable for pole mounting. |
|   | .4  | Panel to be complete with required components including but not limited to.  |
|   | .1  | 1 main circuit breaker with thermal magnetic trip and suitable current rating for station load   |
|   | .2  | 1 single phase ground detector, neon lamp type with resistors and fuse cut-outs  |
|   | .3  | 1 motor circuit interruptor with toggle handle for each pump motor with adjustable instantaneous trip.   |
|   | .4  | 1 magnetic full voltage starter with 120 volts coils and 3 overload relays for each pump   |
|   | .5  | 1 time delay-relay, 2-50 second range, 10 amp minimum resistive contacts to prevent concurrent starting of pumps after power restoration           |
|   | .6  | Mount following switches and instrumentation on door of panel  |
|   | .5  | Mount following switches and instrumentation on door of panel:   |
|   | .1  | Pump mode selector switches for hands-off-automatic operation of each pump   |
|   | .2  | Pump sequence selector switch to permit override of automatic pump alternation and selection of either pump to run as lead pump                    |
|   | .3  | 1 high level alarm complete with alarm relay and red light on panel door.  |
|   | .6  | Terminals in circuit of start float switch of lag pump.  |
|   | .7  | Ground connection lug.   |
|   | .8  | Labels: all components on and inside panel to indicate operating routine. Labels to be anodized aluminum with [5] mm minimum letters.              |
|   | .9  | Schematic wiring diagram: mounted inside panel door, varnish protected.  |
|   | .10 | Conductors: copper.  |
|   | .11 | Control wiring: minimum number 14 AWG, stranded type TEW.  |

		.12			Power wire: minimum number 12 AWG, type RW 90.
		.13			Wire.
			.1		Numbered with printed permanent indelible identifying plastic tapes to correspond to schematic diagram
			.2		Terminated for external control connections by tubular screw type terminal blocks with barrier and labels
			.3		Equipped with grommet and shields for mechanical protection.
			.4		Adequately supported and installed to approval of [Engineer] [Consultant]
2.8	Package System		.1		Polyethylene, plastic or composite enclosure complete with all components specified herein.
			.2		Acceptable material: per Section 33 36 01 – Utility Septic Tanks and Wastewater Treatment Systems.
2.9	Factory Testing		.1		Perform operational tests on pumps at factory to check for excessive vibration, for leaks in piping or seals and for correct operation of automatic control system and auxiliary equipment. Pump suction and discharge lines to be coupled to reservoir and pumps to recirculate water for minimum of [1] hour under simulated service conditions
			.2		Provide certification that pumps and controls have been factory tested and all deficiencies rectified prior to delivery to site.
 <b>PART 3 - EXECUTION</b>					
3.1	Excavation, Backfilling and Compaction		.1		Excavate, backfill and compact in accordance with Section 31 00 99 – Earthworks for Minor Works and as indicated.
3.2	Concrete		.1		Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
3.3	Equipment Installation		.1		Install equipment, piping and controls in accordance with manufacturers' recommendations.

- 3.4 Waterproofing .1 Waterproof in accordance with manufacturers' recommendations.
  
- 3.5 Field Quality Control
  - .1 After completion of installation, demonstrate functional operation of systems, including sequence of operation, to approval of Departmental Representative.
  - .2 Test in presence of Departmental Representative and representative from equipment supplier.
  - .3 Provide labour and ancillary equipment necessary to fulfill tests.
  - .4 Test to demonstrate that.
    - .1 Pumps and equipment run free from heating, or vibration
    - .2 Operation meets requirements of these specifications
    - .3 Pumps and pumping are free and clear of debris and obstructions.
  - .5 Replace equipment found defective. Repeat test until equipment is accepted by Departmental Representative.
  
- 3.6 Demonstration
  - .1 Operating Personnel Training:
    - .1 Provide on site training by qualified personnel for designated operating personnel prior to final commissioning. Training to be in accordance with training plan approved by Departmental Representative.
    - .2 Provide training for 3 designated personnel on all routine maintenance procedures, minor repairs, replacement of parts, including disassembly of major components
    - .3 Provide safety precaution procedures for all systems.
  - .2 Water Height Test:
    - .1 Upon completion of pump station and prior to backfilling the utility drainage field, conduct water height spray testing.
    - .2 Pump station to be filled with potable water.
    - .3 Both pumps to be tested. Valve on each lateral to be adjusted to control spray height
    - .4 Spray height from perforated pipes in the drainage field to be a minimum of

**END OF SECTION**

PART 1 - GENERAL

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|---|------------------------|----|---|
| 1.1                                       | Related Sections       | .1 | Section 01 33 00 - Submittal Procedures.  |
|   |                        | .2 | Section 01 74 21 - Construction/ Demolition Waste Management And Disposal.                            |
|   |                        | .3 | Section 31 00 99 – Earthworks for Minor Works.  |
| <hr style="width: 20%; margin-left: 0;"/> |                        |    |   |
| 1.2                                       | Measurement Procedures | .1 | Measure hydraulic seeding in square metres of actual surface area for:                                |
|   |                        | .1 | Grass mixture including fertilizer.   |
|   |                        | .2 | Measure maintenance during establishment period and warranty period of areas seeded in square metres. |
| <hr style="width: 20%; margin-left: 0;"/> |                        |    |   |
| 1.3                                       | Submittals             | .1 | Product Data.   |
|   |                        | .1 | Submit product data in accordance with Section 01 33 00 - Submittal Procedures.                       |
|   |                        | .2 | Provide product data for:   |
|   |                        | .1 | Seed.   |
|   |                        | .2 | Mulch.  |
|   |                        | .3 | Tackifier.  |
|   |                        | .4 | Fertilizer.   |
|   |                        | .3 | Submit in writing to Departmental Representative 5 days prior to commencing work:                     |
|   |                        | .1 | Volume capacity of hydraulic seeder in litres.  |
|   |                        | .2 | Amount of material to be used per tank based on volume.   |
|   |                        | .3 | Number of tank loads required per hectare to apply specified slurry mixture per hectare.              |

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| <u>1.4</u> <u>Quality Assurance</u>                 | .1 | Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.  |
|   | .2 | Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. |
|   | .3 | Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.                         |
| <br><u>1.5</u> <u>Scheduling</u>                    | .1 | Schedule hydraulic seeding to coincide with preparation of soil surface.   |
| <br><u>1.6</u> <u>Waste Management And Disposal</u> | .1 | Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/ Demolition Waste Management And Disposal.                                       |
|   | .2 | Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.  |
|   | .3 | Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.              |

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PART 2 - PRODUCTS

2.1 Materials

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- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
  - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
    - .1 26% Perennial Ryegrass.
    - .2 24% Creeping Red Fescue.
    - .3 14 % Aliske Clover.
    - .4 13% Hard Fescue.
    - .5 9% White Clover
    - .6 8% Timothy
    - .7 4% Canada Bluegrass
    - .8 2% Redtop
  - .2 Mulch: specially manufactured for use in hydraulic seeding equipment, non toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
    - .1 Type I mulch:
      - .1 Made from wood cellulose fibre.
      - .2 Organic matter content: 95% plus or minus 0.5%.
      - .3 Value of pH: 6.0.
      - .4 Potential water absorption: 900%.
  - .3 Tackifier: water soluble vegetable carbohydrate powder.
  - .4 Water: free of impurities that would inhibit germination and growth.
  - .5 Fertilizer:
    - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
    - .2 Complete synthetic, slow release with 16% of nitrogen content in water insoluble form – 16-32-6.

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PART 3 - EXECUTION

- 3.1 Workmanship
- .1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.
  - .2 Clean up immediately, any material sprayed where not intended, to satisfaction of the Departmental Representative.
  - .3 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
  - .4 Protect seeded areas from trespass until plants are established.
- 3.2 Preparation Of Surfaces
- .1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.
  - .2 Cultivated areas identified as requiring cultivation to depth of 25 mm.
  - .3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
  - .4 Obtain Departmental Representative approval of grade and topsoil depth before starting to seed.
- 3.3 Fertilizing Program
- .1 Fertilize prior to fine grading incorporating fertilizer equally distributed in accordance with manufacturers recommendations.
  - .2 Fertilize twice during establishment and warranty periods.
- 3.4 Preparation Of Slurry
- .1 Measure quantities of materials by weight or weight calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
  - .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
  - .3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

- 3.5 Slurry Application
- .1 Hydraulic seeding equipment:
    - .1 Slurry tank.
    - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/ or mechanical agitation method.
    - .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
  - .2 Slurry mixture applied per hectare to be per manufacturers recommendations.
  - .3 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
    - .1 Using correct nozzle for application.
    - .2 Using hoses for surfaces difficult to reach and to control application.
  - .4 Blend application 300 mm into adjacent grass areas or sodded areas and previous applications to form uniform surfaces.
  - .5 Re apply where application is not uniform.
  - .6 Remove slurry from items and areas not designated to be sprayed.
  - .7 Protect seeded areas from trespass satisfactory to the Departmental Representative.
  - .8 Remove protection devices as directed by the Departmental Representative.
- 3.6 Maintenance During Establishment Period
- .1 Perform following operations from time of seed application for a minimum of two months or until acceptance by Departmental Representative .
  - .2 Grass Mixture:
    - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
    - .2 Mow grass to 50 mm whenever it reaches height of 70 mm.

Remove clippings which will smother grass.

- .3 Fertilize seeded areas after first in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles ;water in well.
- .4 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
- .5 Water seeded areas to maintain optimum soil moisture level for germination and continued growth. Control watering to prevent washouts.

3.7 Acceptance

- .1 Seeded areas will be accepted by Departmental Representative provided that:
  - .1 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.
  - .2 Areas have been mown at least twice.
  - .3 Areas have been fertilized.
- .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.8 Maintenance During Warranty Period

- .1 Perform following operations from time of acceptance until end of the one year warranty period:
  - .1 Repair and reseed dead or bare spots to satisfaction of the Departmental Representative.
  - .2 Mow areas seeded, remove clippings, as directed by Departmental Representative, a minimum of four times during the warranty period.
  - .3 Fertilize seeded 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.

3.9 Cleaning

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

Onsite Wastewater Disposal and Treatment System

**32 92 19.16**

Queen Charlotte City, BC

HYDRAULIC SEEDING

Project No. R. 064179.001

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**END OF SECTION**

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**PART 1 - GENERAL**

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|-------|------------------------|----|---|
| 1.1   | Section Includes       | .1 | Materials and installation for gravity sewers.  |
| <hr/> |                        |    |   |
| 1.2   | Related Sections       | .1 | Section 01 33 00 – Submittal Procedures.  |
|       |                        | .2 | Section 01 74 21 – Waste Management and Disposal.   |
|       |                        | .3 | Section 03 30 00 – Cast in Place Concrete   |
|       |                        | .4 | Section 31 00 99 – Earthworks for Minor Works   |
| <hr/> |                        |    |   |
| 1.3   | Measurement Procedures | .1 | Measure supply and installation of sanitary sewer, including excavating and backfilling, thrust blocks, and granular bedding and surround, in metres of each type and size of pipe installed. Measurement will be made of actual length in place, through valves and fittings, after work has been completed. |
| <hr/> |                        |    |   |
| 1.4   | References             | .1 | American National Standards Institute/American Water Works Association (ANSI/AWWA):   |
|       |                        | .1 | ANSI/AWWA C900-2007, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inch-12 Inch (100 mm-300 mm), for Water Distribution.  |
|       |                        | .2 | American Society for Testing and Materials International, (ASTM):   |
|       |                        | .1 | ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft <sup>3</sup> ) (600kN-m/m <sup>3</sup> )).  |
|       |                        | .2 | ASTM D2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.   |
|       |                        | .3 | ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.   |
|       |                        | .4 | ASTM D3350-12, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.  |
|       |                        | .3 | Canadian General Standards Board (CGSB):  |
|       |                        | .1 | CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.  |
|       |                        | .2 | CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.   |
|       |                        | .3 | CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.  |
|       |                        | .4 | Canadian Standards Association (CSA International):   |
|       |                        | .1 | CSA B1800-11, Plastic Non-pressure Pipe Compendium - B1800 Series . (Consists of B181.1, B181.2,  |

		B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
		.1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
		.2 CSA B182.2-11, PVC Sewer Pipe and Fittings (PSM Type).
		.3 CSA B182.6-11, Profile Polyethylene Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
		.4 CSA B182.11-11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
	.5	Department of Justice Canada (Jus):
		.1 Canadian Environmental Protection Act, 1999 (CEPA).
	.6	Transport Canada (TC):
		.1 Transportation of Dangerous Goods Act, 1992 (TDGA).
1.5	Submittals	
		.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
		.2 Provide Departmental Representative at least 2 weeks prior to beginning Work, with proposed source of bedding materials and provide access for sampling.
		.3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work in accordance with Section 01 33 00 - Submittal Procedures.
		.4 Certification to be marked on pipe.
		.5 Submit manufacturers information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.
1.6	Delivery, Storage and Handling	
		.1 Deliver, store and handle materials in accordance with manufacturers' recommendations.
1.7	Waste Management and Disposal	
		.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
		.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

- 2.1 Plastic Pipe
- .1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 or CSA-B182.2:
    - .1 Standard Dimensional Ratio (SDR): 41.
    - .2 Locked-in gasket and integral bell system.
    - .4 Nominal lengths: 4 m.
  - .2 Acrylonitrile - Butadiene - Styrene (ABS): to ASTM D2680 or CSA-B182.2.
  - .3 Corrugated High Density Polyethylene (HDPE): to ASTM D3350 or CSA-B182.6.
    - .1 180 kPa pipe stiffness.
    - .2 Sewer class
    - .3 Gasket and bell] or Mechanical non-gasket coupling system.

- 2.2 Pipe Bedding and Surround Materials
- .1 Granular material to Section 31 00 99 – Earthworks for Minor Works and following requirements:
    - .1 Crushed or screened stone, gravel or sand.
    - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .2 Table.

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

- .3 Concrete mixes and materials for thrust blocks to Section 03 30 00 - Cast-in-Place Concrete.

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2.3 Backfill Material .1 As indicated.

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### PART 3 - EXECUTION

3.1 Preparation .1 Pipes and fittings to be clean and dry.  
 .2 Prior to installation, obtain Departmental Representative's approval of pipes and fittings.

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3.2 Trenching .1 Do trenching Work, in accordance with Section 31 00 99 – Earthworks for Minor Works.  
 .2 Do not allow contents of any sewer or sewer connection to flow into trench.  
 .3 Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.

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3.3 Granular Bedding .1 Place granular bedding in unfrozen condition.  
 .2 Place granular bedding material in uniform layers not exceeding 200 mm compacted thickness to depth as indicated.  
 .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.  
 .4 Shape transverse depressions as required to suit joints.  
 .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.  
 .6 Fill excavation below design elevation of bottom of specified bedding with common backfill.

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3.4 Installation .1 Lay pipes in accordance with manufacturer's recommendations.  
 .2 Join pipes in accordance with manufacturer's recommendations.  
 .3 Avoid damage to machined ends of pipes in handling and moving pipe.  
 .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.  
 .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.  
 .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.  
 .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.  
 .7 Do not allow water to flow through pipe during construction.  
 .8 Whenever Work is suspended, install removable watertight

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- bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
  - .10 Pipe jointing:
    - .1 Install gaskets [in accordance with manufacturer's recommendations
    - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
    - .3 Align pipes before joining.
    - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material
    - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
    - .6 Complete each joint before laying next length of pipe.
    - .7 Minimize joint deflection after joint has been made to avoid joint damage
    - .8 At rigid structures, install pipe joints not more than [1.2 ] m from side of structure.
    - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
  - .11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
  - .12 Plug lifting holes with pre-fabricated plugs approved Departmental Representative, set in shrinkage compensating grout.
  - .13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
  - .14 Make watertight connections to manholes or plastic tanks.
    - .1 Use shrinkage compensating grout when suitable gaskets are not available
  - .15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.
    - .1 Joints to be structurally sound and watertight.

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|-------|--------------------------------|--|
| 3.6   | Pipe Surround                  | <ul style="list-style-type: none"> <li>.1 Place surround material in unfrozen condition.</li> <li>.2 Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.</li> <li>.3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 200 mm compacted thickness as indicated. Do not dump material within 2 m of pipe.</li> <li>.4 Place layers uniformly and simultaneously on each side of pipe</li> <li>.5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.</li> <li>.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.</li> <li>.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.</li> </ul>  |
| <hr/> |                                |  |
| 3.7   | Backfill                       | <ul style="list-style-type: none"> <li>.1 Place backfill material in unfrozen condition.</li> <li>.2 Place backfill material, above pipe surround in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.</li> </ul>   |
| <hr/> |                                |  |
| 3.8   | Field Testing of<br>Force main | <ul style="list-style-type: none"> <li>.1 Repair or replace pipe, pipe joint or bedding found defective.</li> <li>.2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 95% of nominal pipe diameter through sewer to ensure that pipe is free of obstruction.</li> <li>.3 Remove foreign material from sewers and related appurtenances by flushing with water.</li> <li>.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.</li> <li>.5 Do infiltration and exfiltration testing as specified herein and as directed by Departmental Representative. <ul style="list-style-type: none"> <li>.1 Perform tests in presence of Departmental Representative.</li> <li>.2 Notify Departmental Representative 24 hours in advance of proposed tests.</li> </ul> </li> <li>.6 Carry out tests on each section of sewer between successive manholes including service connections.</li> <li>.7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.</li> <li>.8 Exfiltration test. <ul style="list-style-type: none"> <li>.1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun</li> </ul> </li> </ul> |

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- .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.
  - .3 Duration of exfiltration test: 2 hours.
  - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes
  - .9 Infiltration test.
    - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used
    - .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
    - .3 Install watertight plug at upstream end of pipeline test section.
    - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter
    - .5 Prevent damage to pipe and bedding material due to flotation and erosion.
    - .6 Place 90 degrees V-notch weir, or other measuring device approved by Departmental Representative in invert of sewer at each manhole.
    - .7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval
  - .10 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100 m of sewer including service connections.
    - .1 Exfiltration, based on 600 mm head: 0.175 L
    - .2 Infiltration: 0.150 L.
  - .11 Repair and retest sewer line as required, until test results are within limits specified.
  - .12 Repair visible leaks regardless of test results.

**END OF SECTION**

**PART 1 - GENERAL**

<b>1.1 Section Includes</b>	.1	Materials and installation for sewage force mains.
<hr/>		
<b>1.2 Related Sections</b>	.1	Section 01 33 00 – Submittal Procedures.
	.2	Section 01 74 21 – Waste Management and Disposal.
	.3	Section 03 30 00 – Cast in Place Concrete
	.4	Section 31 00 99 – Earthworks for Minor Works
<hr/>		
<b>1.3 Measurement Procedures</b>	.1	Measure supply and installation of sewage force main, including excavating and backfilling, thrust blocks, and granular bedding and surround, in metres of each type and size of pipe installed. Measurement will be made of actual length in place, through valves and fittings, after work has been completed.
<hr/>		
<b>1.4 References</b>	.1	American National Standards Institute/American Water Works Association (ANSI/AWWA):
	.1	ANSI/AWWA C900-2007, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inch-12 Inch (100 mm-300 mm), for Water Distribution.
	.2	American Society for Testing and Materials International, (ASTM):
	.1	ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
	.2	ASTM C117-13, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
	.3	ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft <sup>3</sup> ) (600kN-m/m <sup>3</sup> )).
	.4	ASTM D2241-09, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
	.5	ASTM D2310-12, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
	.6	ANSI/ASTM D2992-12, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
	.7	ASTM D2996-07, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber- Reinforced Thermosetting Resin Pipe).

- .8 ASTM D3034-08, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - .3 Canadian General Standards Board (CGSB):
    - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
    - .2 CAN/CGSB-8.2-[M88], Sieves Testing, Woven Wire, Metric.
    - .3 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
  - .4 Canadian Standards Association (CSA International):
    - .1 CSA B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
      - .1 CSA B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
      - .2 CSA B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
  - .5 Department of Justice Canada (Jus):
    - .1 Canadian Environmental Protection Act, 1999 (CEPA).
  - .6 Transport Canada (TC):
    - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
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- 1.5 Submittals
    - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
    - .2 Provide Departmental Representative at least 2 weeks prior to beginning Work, with proposed source of bedding materials and provide access for sampling.
    - .3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work in accordance with Section 01 33 00 - Submittal Procedures.
    - .4 Certification to be marked on pipe.
  - 1.7 Waste Management and Disposal
    - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
    - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

- 2.1 Materials
  - .1 Polyvinyl chloride (PVC) pipe: to CSA-B137.3 or ANSI/AWWA C900:
    - .1 SDR: 18.
    - .2 Pressure Class: 1 MPa.
    - .3 Gasket bell end.
    - .4 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturers specifications
    - .5 Rubber gaskets: to ANSI/AWWA C111/A21.11. Gaskets for mechanical joints to be duck-tipped transition gaskets for PVC.
  - .2 Polyethylene pressure pipes: to CSA-B137.1 or CGSB 41-GP-25M.
    - .1 SDR: 11
    - .2 Joints: to ANSI/AWWA C207, thermal butt fusion or flanged with steel or aluminum backing flanges.
    - .3 Polyethylene fittings: to CSA-B137.1, for pipe sizes 4" and less.
- 2.2 Pipe Bedding and Surround Materials
  - .1 Granular material to Section 31 00 99 – Earthworks for Minor Works and following requirements:
    - .1 Crushed or screened stone, gravel or sand.
    - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .2 Table.

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

- .3 Concrete mixes and materials for thrust blocks to Section 03 30 00 - Cast-in-Place Concrete.
- 2.3 Backfill Material .1 As indicated.

PART 3 - EXECUTION

- 3.1 Preparation
- 
- .1 Pipes and fittings to be clean and dry.
  - .2 Prior to installation, obtain Departmental Representative's approval of pipes and fittings.
- 3.2 Trenching
- 
- .1 Do trenching Work, in accordance with Section 31 00 99 – Earthworks for Minor Works.
  - .2 Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.
- 3.3 Granular Bedding
- 
- .1 Place granular bedding in unfrozen condition.
  - .2 Place granular bedding material in uniform layers not exceeding 200 mm compacted thickness to depth as indicated.
  - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
  - .4 Shape transverse depressions as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
  - .6 Fill excavation below design elevation of bottom of specified bedding with common backfill.
- 3.4 Installation
- 
- .1 Lay pipes in accordance with manufacturer's recommendations.
  - .2 Join pipes in accordance with manufacturer's recommendations.
  - .3 Avoid damage to machined ends of pipes in handling and moving pipe.
  - .4 Maintain grade and alignment of pipes.
  - .5 Align pipes carefully before jointing.
  - .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
  - .7 Support pipe firmly over entire length, except for clearance necessary at couplings. Do not use blocks to support pipe.
  - .8 Keep pipe and pipe joints free from foreign material.
  - .9 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed
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			gaskets clean, lubricate and replace before jointing is attempted.
	.10		Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
	.11		Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.
	.12		Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Departmental Representative.
	.13		When stoppage of Work occurs, block pipe to prevent creep during downtime.
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3.5	Thrust Blocks	.1	Restrain bends, tees and fittings by concrete thrust blocks as indicated.
		.2	Keep pipe couplings free of concrete.
		.3	Bearing area of thrust blocks to be as indicated.
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3.6	Pipe Surround	.1	Place surround material in unfrozen condition.
		.2	Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
		.3	Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 200 mm compacted thickness as indicated. Do not dump material within 2 m of pipe.
		.4	Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.
		.5	Compact each layer from mid height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.
		.6	When field test results are acceptable to Departmental Representative, place surround material at pipe joints.
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3.7	Backfill	.1	Place backfill material in unfrozen condition.
		.2	Place backfill material, above pipe surround in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.
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3.8	Field Testing of Force main	.1	Testing of force main to be carried out in presence of the Departmental Representative.
		.2	Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.
		.3	Expel air from force main, by slowly filling main with water. Drill and tap high points and install suitable cocks to vent air and to be shut

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- when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.
- .4 Apply hydrostatic test pressure of 95 kPa based on elevation of lowest point in line and corrected to elevation of test gauge for hydrostatic test and 62 kPa for leakage test.
  - .5 Apply pressure for 1h for pressure test and 2h for leakage test.
  - .6 Examine exposed pipe, joints and fittings while system is under pressure.
  - .7 Remove defective joints, pipe and fittings and replace with new sound material.
  - .8 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2h.
  - .9 Do not exceed allowable leakage.
  - .10 Locate and repair defects if leakage is greater than amount specified.
  - .11 Repeat test until leakage is within specified allowance for full length of force main.
  - .12 Complete backfill.
  - .13 Repeat test after completing backfill. Locate and repair defects and backfill. Repeat tests, repairs and backfills as needed until leakage is less than amount specified.

**END OF SECTION**

PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation for polyethylene and plastic septic tanks and Type III package waste water treatment systems.
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1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 74 21 – Waste Management and Disposal.
		.3	Section 03 30 00 – Cast in Place Concrete
		.4	Section 31 00 99 – Earthworks for Minor Works
		.5	Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type
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1.3	Measurement Procedures	.1	Measurement for utility septic tanks will be based on units of septic tanks supplied and installed, including stripping, excavating, bedding and backfilling.
		.2	Measurement for type III wastewater treatment systems will be based on units of treatment systems supplied and installed, including stripping, excavating, bedding, backfilling, testing, connecting and commissioning.
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1.4	References	.1	American Society for Testing and Materials International, (ASTM):
		.1	ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
		.2	ASTM C117-13, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
		.3	ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft <sup>3</sup> ) (600kN-m/m <sup>3</sup> )).
		.2	Canadian General Standards Board (CGSB):
		.1	CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
		.2	CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
		.3	Canadian Standards Association (CSA International):
		.1	CAN/CSA-B66-10, Prefabricated Septic Tanks and Sewage Holding Tanks.
		.4	British Columbia Ministry of Health – British Columbia Onsite Sewage Association:
		.1	Sewerage System Standard Practice Manual – Version 2.
		.5	Canadian Standards Association (CSA):
		.1	CSA C22.2 No.14, Industrial Control Equipment.
		.2	CSA C22.2 No .0.3, Test Methods for Electrical Wires and

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		Cables.
	.6	National Electrical Manufacturers Association (NEMA).
		.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.
	.7	Canadian Electrical Code (latest edition).
1.5	Design Requirements	
	.1	Design polyethylene or plastic septic tank in accordance with CAN/CSA-B66, and to carry handling stresses and indicated service loads.
	.2	Tanks to have minimum total working capacity of 12,300 L.
	.3	Tanks to be modular in nature and provide locations and volume for the treatment components identified.
	.4	Type III wastewater treatment systems to meet the requirements of the Sewerage System Standard Practice Manual and the following:
		.1 Treat 1,130 L per day.
		.2 Effluent to consistently contain less than 10 mg/L of total suspended solids, have a five day biochemical oxygen demand (BOD <sub>5</sub> ) of less than 10 mg/L, and have a median fecal coliform density of less than 400 Colony Forming Units (cfu) per 100 mL.
		.3 System to include aerobic treatment and ultra-violet light disinfection.
		.4 Blower to be mounted above flood levels.
		.5 Tanks shall be designed to prevent air passage between the settling zone / tank and the treatment zone and preventing an air lock.
1.6	Submittals	
	.1	Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
	.2	Shop drawings to indicate:
		.1 Design calculations for items designed by manufacturer.
		.2 Methods of handling and erection.
		.3 Specifications of manufacturer supplied treatment systems
		.4 Electrical single line diagram.
	.3	Each drawing submission shall bear stamp and signature of a qualified professional engineer registered or licensed in British Columbia as required.
	.4	Shop drawing submittals to be coordinated with shop drawings submitted under Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type.

- .5 Indicate individual components by manufacturer's model number and accompany with technical and performance characteristics.
- 1.7 Waste Management and Disposal
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

**PART 2 - PRODUCTS**

- 2.1 Materials
  - .1 Polyethylene or plastic septic tanks and tanks for wastewater treatment systems to CAN/CSA-B66-10.
  - .2 Type III package treatment plants to meet all requirements of the Sewerage System Standard Practice Manual – Version 2.
  - .3 Ultra-violet disinfection systems to meet electrical code standards.
  - .4 Protective bollards to be 150 mm dia. Schedule 40 steel pipe.
- 2.2 Access
  - .1 Provide access holes to surface to facilitate cleaning inspection.
  - .2 Access hatches to be air tight and secured against tampering.
- 2.3 Tanks Bedding and Surround Materials
  - .1 Granular material to Section 31 00 99 – Earthworks for Minor Works and following requirements:
    - .1 Crushed or screened stone, gravel or sand.
    - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .2 Table.

Sieve Designation	% Passing
200 mm	-
75 mm	-
50 mm	-
37.5 mm	-
25 mm	-
19 mm	-
12.5 mm	100
9.5 mm	-
4.75 mm	80-100
2.00 mm	50- 90
0.425 mm	10- 50
0.180 mm	-
0.075 mm	0- 10

	.3	Verify tank bedding and surround materials with tank manufacturer's recommendations.
	.4	Verify anti-floatation requirements with manufacturers and Departmental Representative. A minimum of six cubic meters of anti-floatation concrete shall be placed around the tanks and anchored to them.
<u>2.4 Backfill Material</u>	.1	As indicated.
<u>2.5 Blower and Aeration Equipment</u>	.1	Regenerative type blower capable of delivering 20-45 CFM (38-85 m3/hr).
	.2	The blower assembly shall include an inlet filter with metal filter element.
	.3	The blower shall be mounted outside the tank on a contractor supplied concrete base.
	.4	Blower piping to the tank shall use non-corrosive material (PVC, Galvanized, or Stainless Steel). Do not run galvanized pipe inside the treatment tank.
<u>2.6 Treatment Media</u>	.1	The treatment media shall be manufactured of rigid PVC, polyethylene, or polypropylene and it shall be supported by the polyethylene insert.
	.2	The media shall be fixed in position and contain no moving or wearing parts and shall not corrode.
	.3	The media shall be designed and installed to ensure that sloughed solids descend through the media to the bottom of the septic tank.
<u>2.7 Electrical and Controls</u>	.1	All components to be CSA approved.
	.2	Electrical equipment in station to requirement for Hazardous

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- Locations, Class 1, Group D, Division 2.
- .3 Panel enclosure to NEMA 3 weather proof of fabricated steel suitably braced, double door equipped with locking device, suitable for pole mounting.
  - .4 The electrical source should be within 150 feet [45 meters] of the blower, consult local codes for longer wiring distances. All wiring must conform to all applicable codes(IEC, NEC, etc.). Wiring distances must prevent significant voltage loss. Input power on 60Hz electrical systems 110/220VAC, 1 $\emptyset$ , 5/2.5 FLA, on 50 Hz electrical systems 220VAC, 1 $\emptyset$ , 5.7 FLA. Other voltages and phase are also available. Actual power consumption varies with site conditions. All conduit and wiring shall be supplied by contractor.
  - .5 The control panel provides power to the blower with an alarm system consisting of a visual and audible alarm capable of signalling blower circuit failure and high water conditions. The control panel is equipped with a timed control feature that is compatible with the treatment plant. A manual silence button is included
  - .6 Panel to be complete with required components including but not limited to.
    - .1 1 main circuit breaker with thermal magnetic trip and suitable current rating for station load
    - .2 1 single phase ground detector, neon lamp type with resistors and fuse cut-outs
    - .3 1 motor circuit interruptor with toggle handle for each blower with adjustable instantaneous trip.
    - .4 Mount following switches and instrumentation on door of panel
  - .7 Ground connection lug.
  - .8 Labels: all components on and inside panel to indicate operating routine. Labels to be anodized aluminum with [5] mm minimum letters.
  - .9 Schematic wiring diagram: mounted inside panel door, varnish protected.
  - .10 Conductors: copper.
  - .11 Control wiring: minimum number 14 AWG, stranded type TEW.
  - .12 Power wire: minimum number 12 AWG, type RW 90.
  - .13 Wire:
    - .1 Numbered with printed permanent indelible identifying plastic tapes to correspond to schematic diagram
    - .2 Terminated for external control connections by tubular screw

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- type terminal blocks with barrier and labels
  - .3 Equipped with grommet and shields for mechanical protection.
  - .4 Adequately supported and installed to approval of the Departmental Representative.

**PART 3 - EXECUTION**

- |     |                               |    |   |
|-----|-------------------------------|----|---|
| 3.1 | Installation                  | .1 | Place bedding and surround material in unfrozen condition.  |
|     |                               | .2 | Do excavation in accordance with Section 31 00 99 – Earthworks for Minor Works.   |
|     |                               | .3 | Place tank bedding material in accordance with details as indicated. Compact to 95% maximum dry density to ASTM D698. Verify bedding conditions with tank manufacturer's recommendations.                   |
|     |                               | .4 | Make inlet and outlet joints of septic tank and tank used for treatment system watertight.  |
|     |                               | .5 | Do backfilling in accordance with Section 31 00 99 – Earthworks for Minor Works and tank manufacturer's recommendations:  |
|     |                               | .1 | Compact to 90% maximum dry density to ASTM D698.  |
|     |                               | .6 | Place bollards as indicated on drawings.  |
| 3.2 | Testing                       | .1 | Conduct leakage test on septic tank in presence of Departmental Representative, before backfilling. Fill tank to level of effluent pipe, and allow to stand for 24 hours. Allowable leakage is zero.        |
| 3.3 | Treatment Plant Commissioning | .1 | Fill the tank to the normal operating level.  |
|     |                               | .2 | Check for leaks in all water-tight seals.   |
|     |                               | .3 | Turn the blower ON and observe the operation of the airlift. A robust splash should be present.   |
|     |                               | .4 | Check for excessive back pressure: Seal all access covers, place hand about 8 inches (20 cm) from air vent, if air flow is felt then excessive back pressure exists and the system's vent must be upgraded. |
|     |                               | .5 | Check for proper water level over the media. The normal water line should be ~2" (5 cm) over the media.   |
|     |                               | .6 | Check for proper alarm function. Turn OFF the blower circuit breaker and wait for the alarm to sound. If the alarm does not sound after 30 seconds, then review the electrical installation procedures.     |
|     |                               | .7 | Turn the blower back ON.  |
|     |                               | .8 | Backfill the excavation.  |
|     |                               | .9 | Lastly, record the treatment unit's serial number in the Service Manual.  |

**END OF SECTION**

## PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation area(sand mound) type septic tank disposal fields.
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1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
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		.2	Section 01 74 21 – Waste Management and Disposal.
		.3	Section 31 00 99 – Earthworks for Minor Works
		.4	Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type.
		.5	Section 31 32 19.01 – Geotextiles
		.6	Section 32 36 01 – Utility Septic Tanks and Wastewater Treatment Systems.
1.3	Measurement Procedures	.1	Measure septic tank sewage disposal field in number of disposal fields supplied and installed including stripping, excavating, bedding and backfilling.
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1.4	References	.1	American Society for Testing and Materials International, (ASTM):
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		.1	ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
		.2	ASTM C117-13, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
		.3	ASTM D422-63(2007), Standard Method for Particle-Size Analysis of Soils.
		.4	ASTM D4318-10, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
		.2	Canadian General Standards Board (CGSB):
		.1	CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
		.2	CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
		.3	Canadian Standards Association (CSA International):
		.1	CSA B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
		.1	CSA B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
		.2	CSA B1800-10, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11)).
		.1	CSA B182.2-11, PVC Sewer Pipe and Fittings (PSM Type).

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|--|----|---|
|  | .4 | British Columbia Ministry of Health – British Columbia Onsite Sewage Association:   |
|  | .1 | Sewerage System Standard Practice Manual – Version 2, 21 September, 2007.   |
| <u>1.5 Submittals</u>                    | .1 | Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.  |
|  | .2 | Shop drawings to indicate:  |
|  | .1 | Design calculations for items designed by manufacturer.   |
|  | .2 | Methods of handling and erection.   |
|  | .3 | Specifications of manufacturer supplied treatment systems   |
|  | .3 | Shop drawing submittals to be coordinated with shop drawings submitted under Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type.       |
| <u>1.6 Quality Assurance</u>             | .1 | Use certified installers who comply with local authority having jurisdiction.   |
| <u>1.7 Waste Management and Disposal</u> | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. |
|  | .2 | Remove from site and dispose of packaging materials at appropriate recycling facilities.  |

PART 2 - PRODUCTS

- 2.1 Granular Materials
- 
- .1 Granular material to Section 31 00 99 – Earthworks for Minor Works and following requirements:
    - .1 Pit run crushed or screened stone, gravel or sand.
    - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .2 Table.

Sieve Designation	% Passing	
	Sand	Stone
200 mm	-	
75 mm	-	
50 mm	-	
38.1 mm	-	
25 mm	-	80-100
19 mm	-	0-5
12.5 mm	100	
9.5 mm	-	
4.75 mm	80-100	
2.00 mm	50- 90	
0.425 mm	10- 50	
0.180 mm	-	
0.075 mm	0- 5	

- 2.2 Impervious Material
 

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  - .1 Material to have Plasticity Index not less than 15% as measured to ASTM D4318.
  - .2 Material to have minimum of 50% of particles finer than 0.075 mm as measured to ASTM D422.
- 2.3 Imported Filter Material
 

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  - .1 Sand conforming to requirements of local authority having jurisdiction.
- 2.4 Geotextile Cover
 

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  - .1 Geotextile cover: to Section 31 32 19.01 - Geotextiles.
    - .1 UV resistant polyolefin fabric.
    - .2 as indicated.

2.5	Pipe for Disposal Fields	.1	Straight PVC pipe and fittings to CAN/CSA-B182.2. Perforated or unperforated as indicated.
2.6	Distribution Box	.1	PVC or corrosion resistant plastic as indicated and to Section 33 36 01 Utility Septic Tanks and Wastewater Treatment Systems.
2.7	Source Quality Control	.1	If requested provide Departmental Representative with 3 certified copies o factory tests of pipe materials.
<b>PART 3 - EXECUTION</b>			
3.1	Area Type	.1	Rough grade to depths as indicated.
	Disposal Field	.2	Scarify area under dry conditions.
	Installation	.3	Place sand material in unfrozen condition as indicated.
		.4	Leaching bed fill material (imported filter material) to meet the requirements for sand mounds as described in the Sewerage System Standard Practice Manual – Version 2 and be pre-approved by Departmental Representative prior to its mass importation to site.
		.5	Obtain Departmental Representative approval to operate construction equipment across disposal field.
		.6	Place minimum approved sand mound material under each distribution pipe location as indicated.
		.7	Install header between pump chamber and leaching bed. Header to be of water-tight construction.
		.8	Header: set level as indicated.
		.9	Connect lengths and place distribution pipe on bedding material as indicated and cover with minimum 50 mm of bedding material to width of 600 mm.
		.10	Place geotextile as indicated.
		.11	Connect each distribution pipe individually to header.
		.12	Connect free ends of distribution lines.
		.13	Maintain pipe elevations within 5 mm of inverts indicated.
		.14	Do not cover disposal field area until pipe grade and alignment have been approved by Departmental Representative.
		.15	Cover disposal field as indicated. Material to be approved by Departmental Representative. Do not compact. Overfill to allow for settlement.
		.17	Grade areas surrounding disposal field bed as indicated, to provide

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for diversion of surface run off waters.

3.2 Testing

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- .1 Conduct pump testing and measure height of spray above perforated pipes in accordance with Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type.

**END OF SECTION**

Onsite Wastewater Disposal and Treatment System

Queen Charlotte City, BC

APPENDIX

Project No. R. 064179.001

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Waste Water Rehabilitation Feasibility Report – Wedler Engineering LLP (edited  
for Tender purposes)

15 pages

APPENDIX

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Wedler Engineering LLP  
211-2459 Cousins Avenue  
Courtenay, BC V9N 3N6



October 31, 2013

File Ref: V13-0147/A

Public Works and Government Services Canada  
641-800 Burrard Street  
Vancouver, BC V6Z 2V8

Attention: Gouin Barford, P.Eng., PMP

**Reference: Parks Canada - Queen Charlotte City, BC  
Eng. SVC – Waste Water Rehabilitation – Onsite Wastewater System Feasibility Report**

Per the terms of reference issued to Wedler Engineering LLP by Public Works and Government Services Canada (PWGSC), this letter presents a review and recommendations for rehabilitation of the on-site wastewater system located on the Parks Canada Facility.

The onsite wastewater system feasibility report has been requested as a result of a request to expand the existing facility. The existing wastewater system located on the site was identified to not meet wastewater treatment and disposal regulations. As part of the expansion a request has been made to determine the feasibility of upgrading the existing system to meet regulatory requirements.

#### Site Investigation

The existing Parks Canada facility is located on Cemetary Road in Queen Charlotte City, on the north shore of Skidegate Inlet located on Graham Island in British Columbia. The legal description of the property is Block I, District Lot 16, Queen Charlotte District. The lot size is 11.207ha, and zoned industrial.

The site topography can be generalized as being a plateau on the side of a hill sloping North to South. The plateau consists of a slope of 3% grade draining towards the south, and is bounded by a steep bank on the south and west side of the plateau consisting of a vertical drop of greater than 6m. The North and East boundaries consist of steep banks with an increase elevation ranging from 2-3m. Local staff has indicated that the plateau was modified by the original developer by blasting the upper side of the hill. This blasted material was moved over the edge of the bank extending the plateau. For details regarding the site topography see *Appendix A: Drawing V13-0147/A*.

The subject property is bounded both north by an existing logging road, and south by Cemetary Road. In addition, bounding the subject property to the east is what appears to be an existing borrow pit for gravel material, and west is an existing residence consisting of a mobile home.

Located on the north side of the site are two existing permanent dwellings, and a fenced storage yard. The primary dwelling has an approximate footprint of 560 sq.m and consists of a split warehouse and office. The primary dwelling's foundation consists of a concrete slab on grade foundation. The secondary dwelling has an approximate footprint of 125 sq.m., and is located at the North East corner of the site. The foundation of the

secondary dwelling is a combination of concrete blocks and slab on grade. The dwelling appears to be a combination of a modular structure with a timber frame addition. No access to the secondary dwelling was available during the site investigation, however it was indicated by staff that it was predominantly used for storage. Both primary and secondary dwellings did not appear to have perimeter drains associated with the foundations.

An existing fenced storage yard is located on the west side of the existing primary dwelling, and has been identified as a proposed building expansion area. Please see figure 1 below showing a photo taken of the above mentioned facilities.



Figure 1: Site photo of existing facility

The remaining southern and western portion of the site is predominantly used for vehicle access and equipment storage such as boats and trailers. In addition, a number of temporary storage structures were located throughout the western and southern portions of the site.

Parks Canada was not able to provide any as-built record drawings for the existing wastewater treatment system. Furthermore, a request for filing records was made with the Northern Health Authority, regional managers of the areas sewerage filing system, and the only records of a system registered on the property were from 1980. A note on file indicated that the registered system was not constructed, and therefore there doesn't appear to be any records of a sewerage system on the subject property.

Based on a site appraisal report, it is believed the existing system was constructed prior to 1999. It is noted that the current regulation, the Sewerage System Regulation, was made law in 2004, thus the existing system predates this and would therefore not have been built to current standards. The appraisal report identifies that there is a plastic tank and a field in front of the building. The existing tank was located and is situated 30m from the onsite well. Based on a review of the site, there doesn't appear to be any indications of an existing field. The front of the property where the tank is located receives significant vehicle loading and storage equipment. Remnants of fire pits also exist in the area where field would expect to be. Based on the site investigation and local staff indicating that they have no records of an existing field it is believed that the existing tank is most likely acting as both the treatment and disposal system. Historically, it was common for old systems to be installed that consisted of a septic tank without a tank bottom, or perforations throughout the bottom.

A site topographic survey was completed at the time of the site investigation. This site topographic survey was prepared to establish site design control tying in the legal property lines to the existing site infrastructure. In addition, the survey identifies the existing ground surface features such as ground slope and grade break lines. This information is used to identify the constraints pertaining to locating an appropriate location for a wastewater treatment system.

During the topographic survey one onsite, and one offsite well was identified. The onsite well which provided potable water to the facility is located approximately 7m off the south west corner of the primary dwelling. It is noted that the water from this well is tested three or four times per year and has had no contamination reported. The onsite well based on a site appraisal is approximately 24m deep and was drilled prior to 1987. The second well was located offsite adjacent to the western property line, and services an existing mobile home located on the neighboring property.

Subsurface Investigation

A subsurface investigation was completed during the July 17<sup>th</sup>, 2013 site visit. The subsurface investigation consisted of two percolation and two test pits performed in accordance with the Sewerage System Standard Practice Manual (SSSPM).

Reviewing the site constraints such as building locations, proposed expansion area, vehicle traffic areas, and setback requirements in accordance with the SSSPM, the locations available for a wastewater disposal system are very limited. Discussions with the Parks Canada Facility Operator and Project Architects have limited the appropriate wastewater treatment and disposal system to one particular location.

There are also setbacks recommended by the SSSPM, which are summarized below and shown on the conceptual design drawings:

Distance to	From a type 3 System	From a watertight sub-surface tank
Source of drinking water, well or water suction lines	30 m	15 m
High pumping rate water supply system well	60 m	30 m
High pumping rate water supply system well in unconfined aquifer	90 m	
Break-out point or downslope drain (including perimeter drain)	7.5 m	1 m
Fresh water	15 m	10 m
Fresh water (seasonal)		
Marine Water		

This location was specifically chosen as it was the furthest location on the site from the two wells identified in the site investigation. See Figure 2 below which shows the existing condition of the chosen location.





Figure 2: Proposed Wastewater Treatment and Disposal Location

Once the location was identified two test pit, and two percolation hole locations were chosen. As indicated above the site's topography and therefore subsurface conditions were altered during its initial development, and this was apparent in the test pit refuse. In general, subsurface soil conditions observed in the test pits (1.0 – 1.2m deep) excavated with a small excavator within the area chosen to be appropriate for a disposal field location. Soils observed consisted of a surface layer of 0-5cm of light brown, stony, dense topsoil. Hard, dense, fractured shale (Fill material) was found to be approximately 0.8 – 1.1m below topsoil. Bedrock shale was observed in test pit 2 at 0.91m below grade. Please note garbage refuse was encountered in Test Pit 1 at a depth of 0.6m below grade. Photos of the test pit excavations can be observed in Appendix B: Field Photo Report.

Groundwater was observed in test pit 1 at a depth of approximately 1.0m below surface grade, and no groundwater was observed in test pit 2. Groundwater levels and surface runoff can be expected to fluctuate seasonally with cycles of precipitation and conditions at other times, and locations may differ from those observed at the time of our assessment.

Two percolation holes were dug in the vicinity of the proposed disposal field location. Infiltration tests were performed in the holes and the results yielded a very high infiltration rate. At onset, a standard garden hose was used to fill the holes, and the height of the water level was not increasing. The infiltration rate was greater than the flow rate of the hole. After approximately 5-10 minutes the ground became saturated and a percolation test was able to be performed. The percolation tests for both holes yielded an infiltration rate of less than 1.0 minutes per inch of drawdown. Photos of the percolation hole excavations can be observed in *Appendix B: Field Photo Report*.

### Conceptual Sewerage System Design

Based on the above surface, and subsurface conditions it is recommended that the existing sewerage system be replaced. It is believed the current system has a high potential to contaminate the current onsite and offsite wells through seepage of the systems wastewater sewerage into the groundwater table.

Due to the high infiltration rate of the onsite soil and the proximity of wells it is believed two feasible alternatives are available for onsite waste water handling.

1. Onsite wastewater storage with offsite treatment and disposal, or
2. High level onsite wastewater treatment and disposal.

Based on the data provided by Parks Canada it has been estimated that the current facility as a light industrial site with a peak staffing of 10 personnel. Using the SSSPM as a design guideline a sewerage system design for this facility should be capable of handling a Daily Design Flow (DDF) rate of 750L/day. It has been indicated by Parks Canada staff that additional capacity should be allotted in the design to allow for future expansion. Therefore, an additional flow capacity of 380L/day, equivalent to a small residential suit, has been allocated to the DDF bringing the total DDF to 1130L/day.

#### *Option #1: Onsite wastewater storage with offsite treatment and disposal*

A standard method of handling onsite waste water is providing an onsite storage system, and contracting a local contractor to pump and haul the onsite waste water to a local wastewater treatment facility. Queen Charlotte City has an existing treatment facility, and discussions with local contractors have indicated that this method is done for some local facilities.

In order to facilitate an onsite storage system an in ground storage tank would be required to be constructed on site. Historically, concrete tanks are used in these situations, however they are known to crack and seep over time as the tank and the surrounding soil settles. Due to the high infiltration of the site it would be recommended that alternatively a plastic tank be used. A review of available manufacturers has shown that the largest available polyethylene tanks manufactured for wastewater systems are 6150 liters. Larger tanks are available but are fiberglass reinforced and are more expensive. For the purpose of estimating it has been assumed two 6150 liter polyethylene tanks would be necessary providing a maximum storage capacity of 12,300 liters. At the proposed DDF provided using the SSSPM this would require that the tanks be pumped and the waste water hauled to the local Queen Charlotte waste water treatment facility approximately 34 times a year.

This being said the SSSPM is conservative as it is used for the design of disposal fields and therefore assumes the worst case scenario whereby the facility is operating a peak personnel capacity. The SSSPM therefore tends to provide a larger DDF than what typically occurs in reality. It is believed a more accurate representation of people over the course of a year at the facility would average out to no more than 5 personnel with 10 in the summer and 0 in the winter. Using this information a more accurate number of pump and hauls over the course of a year would be 22 rather than 34. However, for the purposes of this feasibility study estimating has been based on the SSSPM and therefore 34 pump and hauls annually were used in the cost estimating.

*Option 2: High level onsite wastewater treatment and disposal*

Due to the constraints of the site such as; proximity to wells, high infiltration rate, and history of neighboring well fouling, it is recommended that if an onsite waste water treatment and disposal system is chosen for this facility it should be a Type 3 treatment system. Type 3 treatment systems provide a high level of treatment and are typically used when there is very little soil depth available, or very slow or rapid ground infiltration occurs. In the case of this site there is very little natural soil depth, and a very high infiltration rate.

For the purposes of this feasibility assessment a Type 3 treatment system using aerobic treatment and UV disinfection has been assumed. In addition, the treated effluent is discharged to an above ground sand mound system which will regulate the infiltration rate of the discharged waste water.

Conceptual Construction Cost Estimates

As part of the feasibility analysis for the replacement of the existing onsite waste water system a cost comparison of the two alternative options have been prepared. In addition, a 20 year life cycle comparison has been prepared taking into account operating costs. Below is a summary of these cost estimates. For details see *Appendix C – Feasibility Cost Estimates*.

Waste Water System	Construction Cost	Annual Maintenance Cost	20 Year Lifecycle Cost
Onsite Treatment and Disposal	\$XX,XXX.XX	\$XX,XXX.XX	\$XX,XXX.XX
Onsite Storage and Offsite Disposal	\$XX,XXX.XX	\$XX,XXX.XX	\$XX,XXX.XX

The cost estimates above include a 20% contingency. For the purposes of estimating the lifecycle of the proposed onsite treatment system and disposal system has been estimated at 20 years. However, if a Type 3 treatment system is well maintained its lifespan can be significantly increased, and disposal fields have been known to last more than 30 years. Alternatively, a polyethylene storage tank can have a lifespan of up to 40 years. Based on the cost comparison table above it is apparent that the annual maintenance costs of an onsite storage and offsite disposal system outweigh the upfront construction cost of an onsite Type 3 treatment and disposal system.

Alternate Sewage Disposal Options

As outlined in the terms of reference we have provided below a review of some alternative sewage disposal methods.

*Composting Toilets*

A composting toilet is a dry toilet that uses a predominantly aerobic processing system that treats excreta, typically with no water or small volumes of flush water, via composting or managed aerobic decomposition. Most composting toilets require vertical space below the actual toilet for the composting unit. There are maintenance issues that differ from traditional toilets, including:

- Need to regularly remove and dispose of decomposed solid wastes
- Need to drain liquid waste to a safe disposal system
- Possible odor issues to deal with if overused



Composting toilets have a finite capacity, with a limited number of users able to use a single toilet. They require continuous operating effort to maintain the aerobic decomposition, and furthermore can only be cleaned with certain chemicals.

There are now composting toilets that use flushing water, allowing for more flexibility in installation (i.e. the toilet seat does not need to be directly above the waste receptacle). However, with the use of water for flushing, the total amount of waste also increases.

#### *Solids Separation*

Representing a variation on the composting toilet, a solid separating system divides the waste stream at the source, with the liquid and solid waste going to separate treatment systems. Simple versions will have a receptacle for solids in the toilet seat, with the liquid being intercepted within the toilet bowl.

The main difference to a traditional composting toilet is that the solid waste is dryer, and remains more compact. Other issues and factors are similar.

#### *Greywater Recycling*

Independent of the type of toilet chosen the recycling of greywater in a system can result in considerable savings in potable water use and in waste production. Greywater is waste water from low-pollutant load fixtures such as laundry facilities, kitchens (non-commercial), bathroom sinks and showers. Greywater can be used, typically with some treatment, for irrigation or for toilet flushing.

A greywater system will require two sets of drain pipes in a building, some form of treatment for the greywater, potentially a pump and / or pressure system and will need to be accounted for in the disposal and treatment of the effluent.

#### *Limitations of Alternative Solutions*

All of the solutions listed above have some limitations. Despite reducing potable water use, none of the above can reduce the pollutant loading, and none remove the pollutant completely. Composting toilets still produce a liquid waste stream that requires treatment, and solids that require disposal. All also require increased maintenance and operations effort when compared to more conventional on-site wastewater disposal systems.

#### Recommendations

Based on the available site information it is recommended that the existing system be replaced to reduce the current liability and risk associated with the current system contaminating the ground water system and surrounding drinking water wells.

Furthermore, based on site conditions and conceptual construction cost estimates it is recommended that the new system be a Type 3 onsite waste water treatment and disposal system. The proposed waste-water disposal system should consist of an initial storage tank, a treatment system combining air injection and UV filtration, and a pressurized sand mound to disperse and discharge the treated effluent. As can be seen by the 20 year lifecycle cost comparison the costs of an onsite treatment and disposal system should provide a more cost effective system over a 20 year lifecycle period.

Closure

This report is based on the limited field observations and sub-surface investigations conducted. Wedler Engineering LLP assumes no liability for the information contained in this report being used in any manner other than the intended use, that being a review of pre-design and conceptual design options.

Yours truly,  
Wedler Engineering LLP

Per:



Greg Merchant, B.Eng., EIT  
Project Engineer  
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Per:



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Partner • Project Engineer  
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Attached:

- Appendix A: Drawing V13-0147/A, Revision 1: KEYPLAN – Issued for PWGSC Review (1 page)
- Appendix B: Field Photo Report (3 Pages)
- Appendix C: Feasibility Cost Estimates (3 pages)

## APPENDIX A

Drawing V13-0147/A

Revision 1: Conceptual Layout – Issued for PWGSC Review (1 page)





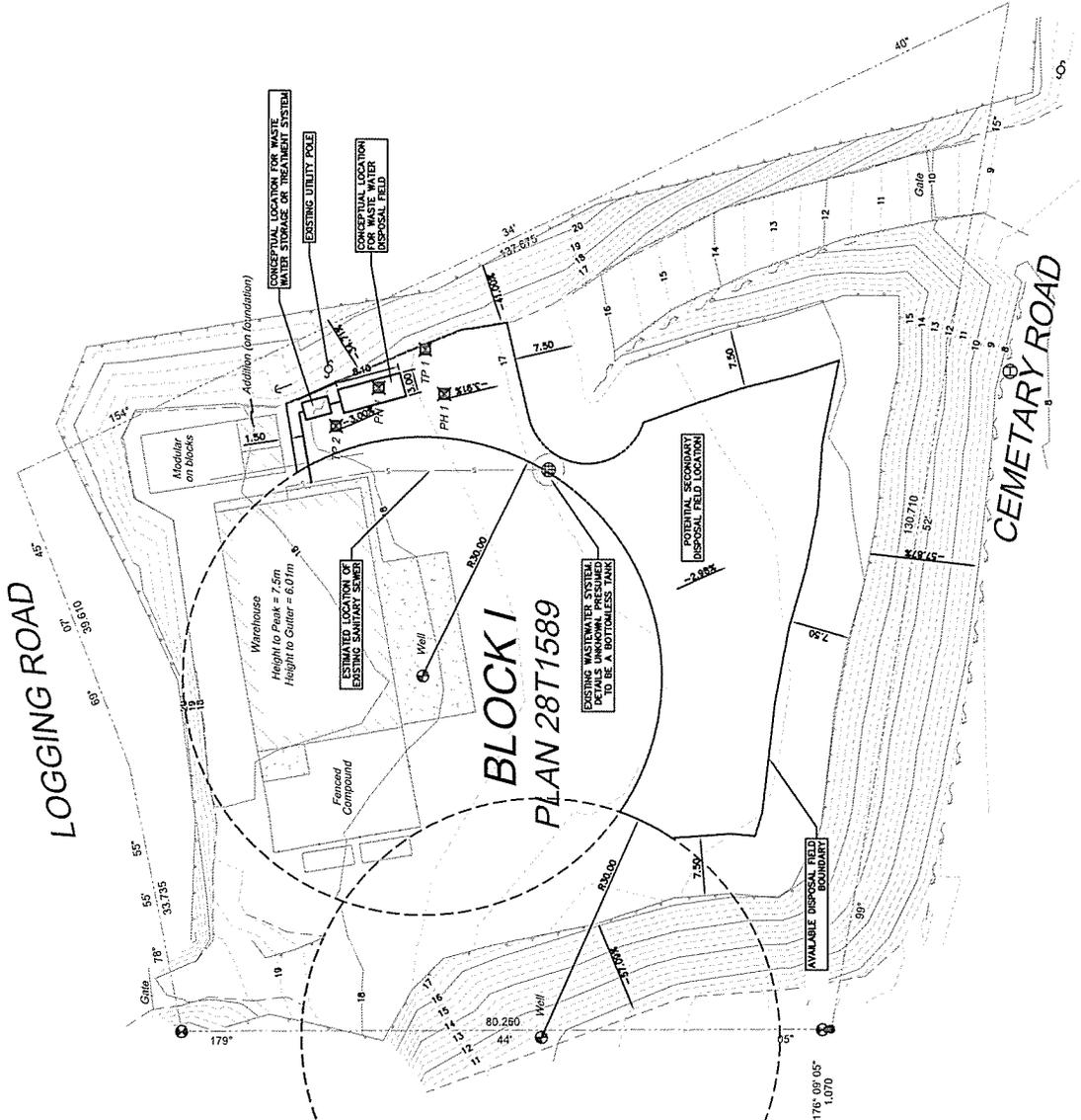
LOGGING ROAD

BLOCK H  
PLAN 9T1576

BLOCK I  
PLAN 28T1589

LQTA  
PLAN 11870

CEMETARY ROAD



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 QUEEN CHARLOTTE CITY, BC

Project No./No. de projet

PARKS CANADA OFFICE  
 WASTE WATER  
 REHABILITATION

Consultant/Consultant  
 WEDLER ENGINEERING LLP

Drawn by/Drawé par  
 Date

Project No./No. de projet  
 0

KEY PLAN

Project No./No. de projet  
 R. C1

Scale/Échelle  
 0

SCALE 1:300

## APPENDIX B

Appendix B: Field Photo Report (3 Pages)



# FIELD PHOTO REPORT

DATE OF PHOTOS: 17th July 2013

SHEET No: 1

CLIENT: PWGSCs

PROJECT NAME: Eng. SVC – Waste Water Rehabilitation  
Parks Canada Facility, Queen Charlotte City

PROJECT No.: V13-0147/A



Percolation Hole #1

Percolation Hole #1: Sample of finer material found shallower in excavation



Percolation Hole #1: Sample of coarser material found throughout excavation



Percolation Hole #2



Percolation Hole #2: Sample of finer material



Percolation Hole #1: Sample of coarser material



Test Pit #1: Large angular boulder excavated



Test Pit #1: Sample of excavated material



Test Pit #1: Water table observed 1.0m below surface.



Test Pit #2: Test pit during excavation



Test Pit #2 : Sample of material excavated



Test Pit #2: Bedrock shale encountered at end of excavation

## APPENDIX C

Appendix C: Feasibility Cost Estimates (3 pages)  
(Excluded for Tender Purposes)

