



**Public Works and  
Government Services Canada**

Requisition No. EZ899 172844/A

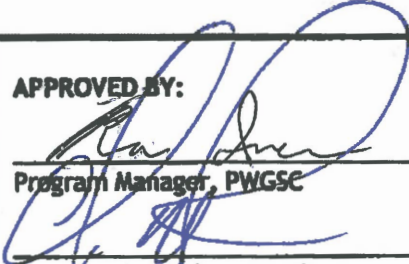
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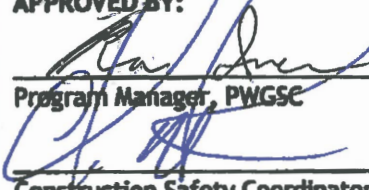
**SPECIFICATIONS  
for**

**Wick Road & Kwisitis Parking Lot Upgrade  
Pacific Rim National Park Reserve  
British Columbia**


Project No. R.089036.001 January 2017

**APPROVED BY:**

  
\_\_\_\_\_  
Program Manager, PWGSC Jan 13 2017  
Date

  
\_\_\_\_\_  
Construction Safety Coordinator 2017.01.13  
Date

**TENDER:**

  
\_\_\_\_\_  
Project Manager 17/02/03  
Date

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# PWGSC

Wick Road & Kwisitis Parking Lot Upgrade  
Pacific Rim National Park Reserve, BC  
Project No. R.080936.001

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Pacific Rim National Park Reserve, BC  
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## **APPENDICES**

<b>Appendix A:</b>	<b>Wick Road and Kwisitis Parking Lot Upgrades Geotechnical Investigation</b> Thurber Engineering Ltd., January 13, 2017.
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**END OF SECTION**

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## PART 1 - GENERAL

- 1.1 Precedence 1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Specifications document.
- 1.2 Definitions .1 “Department” shall mean Public Works and Government Services Canada and is abbreviated as “PWGSC”.
- .2 “Departmental Representative” shall mean a representative appointed by PWGSC for the purpose of execution of this Contract.
- .3 “Owner” shall mean Parks Canada.
- 1.3 Hierarchy of Documents .1 In the event of discrepancies, the hierarchy of documents shall be as follows, in descending order:
- .1 These Specifications.
- .2 If conflict arises between an item in these specifications and an item found in one of the Reference Documents (Appendices) the specification shall govern.
- .3 Any technical and manufacturer’s standard, Government Act, Regulation or Code of practice referred to in the contract documents shall be the version current at the time the contract is awarded.
- .2 In the event of a difference between scaled dimensions on Plans and the figures written thereon, the figures shall govern. In the event that two or more plans show conflicting information, the information on the most recently dated plan shall govern.
- .3 Any technical and manufacturer’s standard, Government Act, Regulation or Code of Practice referred to in the Contract documents shall be the version current at the time the Contract is awarded.
- 1.4 Codes, Bylaws, Standards .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments.
- .2 Perform work in accordance with the Canadian Standards Association; the American Society for Testing of Materials; or the British Columbia Building Code; whichever is applicable and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .3 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .4 Meet or exceed requirements of Contract documents, specified standards, codes, and referenced documents.
-

- .5 In any case of conflict or discrepancy, the most stringent requirements shall apply.
- 1.5 Contract Documents
- .1 The Contract Documents, drawings and specifications, are intended to complement each other, and to provide for and include everything necessary for the completion of the Work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.
- .3 If anything is found by the Contractor to be missing from the Contract Documents immediately inform the Departmental Representative.
- 1.6 Other Contracts
- .1 Further Contracts may be awarded while this contract is in progress.
- .2 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .3 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of this Work.
- 1.7 Division of Specifications
- .1 The specifications are subdivided in accordance with the current 5 or 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.
- 1.8 Project Location
- .1 The project is located along Wick Road within the Pacific Rim National Park Reserve, British Columbia.
- 1.9 Time of Completion
- .1 Complete the fiber optic communication work to provide a fully functioning system within 8 weeks after Contract Award.
- .2 Complete the Work within 30 weeks after Contract Award.
- 1.10 Contract Method
- .1 Construct Work under a Unit Price Contract
- 1.11 Section Includes
- .1 In general, Work under this Contract covers the reconstruction of Wick Road from the Florencia Bay Access Road to the Wickaninnish Beach Access Road along with Kwisis parking lot improvements.
-

- 1.12 Work Included .1 Work includes, but is not limited to:
- .1 Staging of construction and traffic accommodation plan.
  - .2 Reconstruction of roadways.
  - .3 Parking lot improvements including repaving.
  - .4 Installation of culverts and headwalls.
  - .5 Installation sanitary sewer forcemains and water mains.
  - .6 Coordination and communication with other Contractors and agencies involved with Project, if applicable.
  - .7 Management of the Environment.
- .2 "Green" requirements:
- .1 Use only environmentally responsible green materials/ products with no VOC emissions.
  - .2 Use materials/products containing highest percentage of recycled and recovered materials practicable - consistent with maintaining cost effective satisfactory levels of competition.
  - .3 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.
- .3 Unless specifically stated otherwise, the Work is to include the furnishing of all labour, materials, equipment, and services necessary to complete the Work. The intent is that the Contractor provides a complete Job.
- 1.13 Contractor's Responsibility .1 Give all required Notices and comply with all local, provincial, and federal laws, bylaws, ordinances, rules, regulations, codes, and orders relating to the Work which are or become in force during the Performance of the Work.
- .2 As Prime Contractor, coordinate all the Work and provide all labour, materials, equipment, and services necessary for delivery, storage, handling, protection, installation, removal, inspection, and replacement or maintenance as required to provide a complete Project.
- .3 All persons working for the Prime Contractor, including all sub-contractors, are required to attend a tailgate meeting with Park Administration personnel at the Pacific Rim National Park Administration Building regarding procedures for working within the Park. More than one meeting can be arranged to accommodate the Contractor's schedule and work forces.
- 1.14 Hours of Work .1 Restrictive as follows:
- .1 Notify Departmental Representative and Park Administration of all after hours work, including weekends and holidays.
-

- 1.15 Work Schedule .1 Carry on work as follows:
- .1 Within 10 working days after Contract award, provide a "phasing bar chart" and a schedule showing anticipated progress stages and final completion of the Work within the time period required by the Contract documents. Indicate the following:
    - .1 Submission of shop drawings, product data, MSDS sheets, and samples.
    - .2 Commencement and completion of Work of each section of the specifications or drawings as outlined.
    - .3 Final completion date within the time period required by the Contract documents.
  - .2 Do not change approved Schedule - without notifying Departmental Representative.
  - .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.
- 1.16 Documents Required .1 Maintain 1 copy each of the following at the job site:
- .1 Contract drawings.
  - .2 Contract specifications.
  - .3 Addenda to Contract documents.
  - .4 Copy of approved work schedule.
  - .5 Reviewed/approved shop drawings.
  - .6 Change orders.
  - .7 Other modifications to Contract.
  - .8 Field test reports.
  - .9 Reviewed/approved samples.
  - .10 Manufacturers' installation and application instructions.
  - .11 One set of record drawings and specifications for "as-built" purposes.
  - .13 Current construction standards of workmanship listed in technical Sections.
  - .14 Project Safety Plan / Traffic Control Plan.
  - .15 Environmental Protection Plan
  - .16 Copy of approved Work schedule.
  - .17 Labour conditions and wage schedules.
-

- 1.17 Regulatory Requirements
- .1 Obtain and pay for Building Permit, Certificates, Licenses, and other permits required by regulatory municipal, provincial or federal authorities to complete the work.
  - .2 Obtain a Park Business License to work within the Pacific Rim National Park.
  - .3 Obtain a Provincial Highway Use Permit for Highway 4 if equipment will be accessing the highway during the work.
  - .4 Provide inspection authorities with plans and information required for issue of acceptance certificates.
  - .5 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.
- 1.18 Contractor's Use of Site
- .1 Use of site:
    - .1 Exclusive and complete for execution of Work.
    - .2 Assume responsibility for assigned premises for performance of this Work.
    - .3 Be responsible for coordination of all Work activities on site, including the Work of other contractors engaged by the Departmental Representative.
  - .2 Do not unreasonably encumber site with material or equipment.
  - .3 Perform Work in accordance with Contract documents and ensure work is carried out in accordance with indicated phasing as follows:
    - .1 Site to be considered four work zones as follows:
      - .1 Wick Road straight section Sta 0+267 to Sta 1+675,
      - .2 Wick Road curve Sta 5+000 to Sta 5+260,
      - .3 One half the Kwisitis parking lot and access road,
      - .4 Remaining half of the Kwisitis parking lot.
    - .2 Only one section of the roadway and one section of the parking lot can be under construction at any one time.
    - .3 Paving to follow road and parking lot reconstruction in a timely manner. Paving to be commenced once areas have been deemed ready to pave by the Departmental Representative.
    - .4 Roadways to have temporary lane marking until such time of permanent road markings. Parking lot to have sufficient temporary markings to designate parking stalls and drive aisles to the satisfaction of Departmental Representative.
-

- 1.19 Traffic Control .1 Provide a detailed Traffic Management Plan (TMP) with dedicated traffic control and pedestrian delineation for safety of motorists, pedestrians and bicycle traffic for all locations where roadways are affected by construction activities in accordance with Section 01 35 00 Special Procedures for Traffic Control.
- .2 Do not close any lanes of road or highway without written consent of the Departmental Representative. Contractor to keep one lane open to traffic at all times.
- .3 Full road closures are not permitted unless reviewed and accepted by the Departmental Representative, Parks and Public Works a minimum on three weeks prior to any planned road closure.
- 1.20 Examination .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Provide photographs of surrounding properties, objects and structures liable to be damaged or be the subject of subsequent claims.
- 1.21 Existing Services .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the authorities having jurisdiction.
- 1.22 Location of Equipment and Fixtures .1 Location of equipment, fixtures, and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual location.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.
- 1.23 Cutting and Patching .1 Cut existing surfaces only as required to accommodate new work and as directed by the Departmental Representative.
- .2 Remove items so shown or specified.
- .3 Do not cut, bore, or sleeve load-bearing members unless instructed to do so by the drawings and/or specifications.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Fit work airtight to pipes, sleeves, ducts and conduits.
- .6 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material,
-

- colour, finish and texture.
- .7 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.
- 1.24 Setting Out Work
- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Assume full responsibility for dimensions, spacings, overall fit with field components, and exact locations of bolt holes and their spacings.
- .3 Provide devices needed to lay out and construct work.
- .4 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.
- 1.25 Quality of Work
- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 The workmanship, erection methods, and procedures to meet minimum standards set out in the applicable codes and standards.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.
- 1.26 Works Coordination
- .1 Coordinate work of subtrades:
- .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
- .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
- .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
- .1 Identify on coordination drawings, structural elements, services lines, rough-in points, and indicate location of services entrance to site.
- .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
- .4 Publish minutes of each meeting.
-

- .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
  - .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
  - .7 Coordinate and plan for all necessary road/lane closures ahead of time.
  - .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
  - .4 Work cooperation:
    - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
    - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching, and removal or replacement of completed work.
    - .3 Ensure disputes between subcontractors are resolved.
  - .5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
  - .6 Maintain efficient and continuous supervision.
  - 1.27 Approval of Shop Drawings, Product Data and Samples
    - .1 In accordance with Section 01 33 00, submit the requested shop drawings, product data, MSDS sheets, and samples indicated in each of the technical Sections.
    - .2 Allow sufficient time for the following:
      - .1 Review of product data.
      - .2 Approval of shop drawings.
      - .3 Review of re-submission.
      - .4 Ordering of approved material and/or products.
  - 1.28 Project Meetings
    - .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
  - 1.29 Testing and Inspections
    - .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified in Section 01 45 00 – Quality Control.
    - .2 The Contractor will appoint and pay for the services of testing agencies and/or testing laboratories to meet the requirements specified in the Contract documents and where required for the following:
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- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.
  - .3 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
  - .4 Contractor shall notify Departmental Representative in advance of planned testing.
  - .5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
  - .6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
  - .7 The Departmental Representative may require, and pay for, additional inspection and testing services not included here.
  - .8 Provide Departmental Representative with 2 copies of testing laboratory reports and mill tests and certificates of compliance as soon as they are available.
- 1.30 As-Built Documents
- .1 The Departmental Representative in coordination with the Contractor will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for "as-built" purposes.
  - .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings, and shop drawings as changes occur.
- 1.31 Cleaning
- .1 Conduct daily cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
  - .2 Ensure cleanup of the work areas each day after completion of work.
  - .3 In preparation for inspections:
    - .1 Examine all sight-exposed interior and exterior surfaced and concealed spaces.
    - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces.
  - .4 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.
-

- 1.32 Environmental Protection .1 Environmental protection to follow the environmental management plan entitled “Environmental Management Plan - Wick Road and Kwisisit Visitor Centre Parking Lot Upgrades”, prepared by Current Environmental, dated January 25, 2017.
- .2 Prevent extraneous materials from contaminating air, land, or water beyond construction area, by providing temporary enclosures during work.
- .3 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .4 Ensure proper disposal procedures in accordance with all applicable territorial regulations.
- 1.33 Archaeological / Heritage Areas .1 Significant archaeology impacts are not expected with this Work.
- .2 The Contractor is to provide immediate notice to the Departmental Representative if evidence of cultural resources or evidence of archeological finds are encountered during excavation / construction, and await the Departmental Representative’s written instructions before proceeding with any further Work.
- .3 Relics and antiquities and items of historical or scientific interest shall remain the property of Parks Canada. Protect such articles and request directives from Departmental Representative.
- 1.34 First Nations Ceremony .1 Prior to any Work at the site, the First Nations will conduct a ceremonial blessing of the project.
- .2 Representatives from the Contractor’s team are requested to attend the ceremony.
- 1.35 Additional Drawings .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 6 sets of Contract documents for use by the Contractor at no additional cost. Should more than 6 sets of documents be required the Departmental Representative will provide them at additional cost.
- 1.36 Additional Information .1 A general subsurface investigation report entitled “Wick Road and Kwisisit Parking Lot Upgrades Geotechnical Investigation”, prepared by Thurber Engineering Ltd., dated January 13, 2017, is included in the Contract Documents as an Attachment.
- .2 An environmental management plan entitled “Environmental Management Plan - Wick Road and Kwisisit Visitor Centre Parking Lot Upgrades”, prepared by Current Environmental, dated January 25, 2017, is included in the Contract Documents as an Attachment.
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- .3 The information contained in these reports, by its nature, cannot reveal all conditions which exist or can occur at the site. These reports are included for the Contractor's general information only, and no guarantee is given as to the completeness and accuracy of this information. Any actions or assumptions based on the information, recommendations or suggestions contained in this report are entirely the Contractor's responsibility.
- 1.37 System of Measurement .1 The metric system of measurement (SI) will be employed on this Contract.
- 1.38 Submission of Tender .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and is fully conversant with all conditions therein.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Scheduled preconstruction and progress meetings.
- 1.2 Description .1 Coordination of progress schedules, submittals, use of sites, temporary utilities, construction facilities, and construction Work, with progress of work by others under instructions of Departmental Representative.
- 1.3 Construction Project Meetings .1 The Departmental Representative will schedule and administer project meetings as deemed necessary throughout progress of the Work.
- .2 Agenda to include, but not limited to, the following:
- .1 Review and approval of minutes of previous meeting.
  - .2 Review of site safety and security issues.
  - .3 Review of Work progress since previous meeting.
  - .4 Field observations, problems, conflicts.
  - .5 Problems that impede construction schedule.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .11 Maintenance of quality standards.
  - .12 Review proposed changes for affect on construction schedule and on completion date.
  - .13 Environmental Issues including species at risk, critical habitat, and work in and about streams.
  - .14 Archeological issues including Culturally Modified Trees (CMT's) and historical sites.
  - .15 Animal sightings and encounters
  - .16 Other business
  - .17 Schedule next meeting
- .3 The Owner shall provide physical space and arrange for meetings.
- .4 The Departmental Representative will record minutes, including significant proceedings and decisions, identify action by parties, and set time and date for next progress meeting.
- .5 The Departmental Representative will reproduce and distribute minutes within 3 days after each meeting and transmit to meeting participants, affected parties not in attendance, and Contractor.
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- 1.4 Construction Organization and Start-up
- .1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
  - .2 Departmental Representatives and senior representatives of the Contractor, major Subcontractors (if applicable), field inspectors and supervisors will be in attendance.
  - .3 Establish time and location of meeting and notify parties concerned minimum 3 days before meeting.
  - .4 Agenda to include, but not limited to, the following:
    - .1 Appointment of official representative of participants in Work.
    - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 17 - Construction Progress and Reporting.
    - .3 Schedule of submissions in accordance with Section 01 33 00 - Submittal Procedures.
    - .4 Requirements for temporary facilities, storage sheds, utilities, etc. in accordance with Section 01 51 00 - Temporary Utilities.
    - .5 Site security in accordance with Section 01 52 00 - Construction Facilities.
    - .6 Environmental Issues (species at risk, critical habitat, work in and about streams.)
    - .7 Archeological issues (CMT's and historical sites.)
    - .8 Permitting and Environmental Requirements.
    - .9 Proposed suppliers and/or sub-contractors.
    - .10 Proposed hours of work per day and days per week Contractor will normally work.
    - .11 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
    - .12 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 - Closeout Procedures.
    - .13 Monthly progress claims, administrative procedures, photographs, and holdbacks.
    - .14 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 - Quality Control.
    - .15 Insurances and transcript of policies.
    - .16 Other business.
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- .5 Comply with Departmental Representative's allocation of mobilization areas of sites; for field offices and sheds, access, traffic, and parking facilities.
  - .6 During construction, coordinate use of sites and facilities with Departmental Representative.
  - .7 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
- 1.5 Schedules
- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 17 - Construction Progress and Reporting to Departmental Representative coordinated with Departmental Representative's project schedule.
  - .2 After review, revise and resubmit schedule to comply with revised project schedule.
  - .3 During progress of Work revise and resubmit as directed by Departmental Representative.
- 1.6 Submittals
- .1 Submit preliminary shop drawings and product data and samples in accordance with Section 01 33 00 - Submittal Procedures, for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Departmental Representative.
  - .2 Submit Environmental Protection Plans to Departmental Representative.
  - .3 Submit requests for payment for review, and for transmittal to Departmental Representative.
  - .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
  - .5 Process substitutions through Departmental Representative.
  - .6 Process change orders through Departmental Representative.
  - .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative.
- 1.7 Closeout Procedures
- .1 Notify Departmental Representative when Work is considered ready for Substantial Performance, in accordance with Section 01 77 00 – Closeout Procedures.
  - .2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.
  - .3 Comply with Departmental Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance.
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- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

**END OF SECTION**

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**PART 1 - GENERAL**

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|--------------------------|----|--|
| 1.1 Section Includes     | .1 | Schedule submittals required.  |
|                          | .2 | Progress Photographs.  |
| 1.2 Submittals           | .1 | At preconstruction meeting submit a detailed schedule bar chart listing work items and days to complete each item. Clearly show sequence and interdependence of construction activities. |
|                          | .2 | Submit letter ensuring that schedule has been prepared in coordination with major Subcontractors and suppliers, if applicable.   |
|                          | .3 | Update schedule at the end of each week and submit to the Departmental Representative.   |
| 1.3 Progress Photographs | .1 | Provide digital photographs with dates and descriptions on CD disk with progress reports. Relate dates and descriptions to photo file names in a separate text file on disk.             |
|                          | .2 | Number of photographs: minimum of 50 photos to cover all aspects of the work.  |
|                          | .3 | Viewpoints: determined by Contractor to provide history of work.   |
|                          | .4 | Frequency: with progress statement, at completion of each construction stage, and as directed by Departmental Representative.  |

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 This section includes but is not limited to the following:
- .1 Health and Safety Plan.
  - .2 Certificates and Transcripts.
  - .3 Survey and Quality Testing Reports.
  - .4 Warranties
- 1.2 Administrative .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
  - .3 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents.
  - .4 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
  - .5 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
  - .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
  - .7 Keep one reviewed copy of each submission on site.
- 1.3 Progress Photographs .1 Submit progress photographs in accordance with Section 01 32 17 - Construction Progress and Reporting.
- 1.4 Survey and Quality Testing Reports .1 Submit certified survey and quality testing reports with progress reports.

**END OF SECTION**

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**PART 1 - GENERAL**

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|-----------------------------|--|
| 1.1 Section Includes        | .1 Traffic Management Plan.<br>.2 Informational and Warning Devices.<br>.3 Protection and Control of Public Traffic.<br>.4 Operational Requirements.   |
| 1.2 Description             | .1 Provide a detailed Traffic Management Plan (TMP) with dedicated traffic control and pedestrian delineation for safety of motorists, pedestrians and bicycle traffic for all locations where roadways are affected by construction activities.<br>.2 TMP shall be in prepared in accordance with the BC Ministry of Transportation and Infrastructure Traffic Management Manual for Work on Roadways, latest edition, and the 2012 Standard Specifications for Highway Construction.<br>.3 Provide all onsite and offsite traffic delay, traffic control, traffic and bypass route directional signage for the project.<br>.4 The plan shall be submitted to the Departmental Representative for approval. |
| 1.3 Special Provisions      | .1 One lane of traffic must be maintained at all times.<br>.2 Work within the Kwisis parking lot shall be staged such that one half of the parking stalls are available at any given time.<br>.3 Minimize the disruption and time of construction at the entrance to the Kwisis Visitor Centre.  |
| 1.4 Measurement for Payment | .1 The lump sum price bid for this item shall be full compensation for developing and implementing a traffic management plan to control vehicle, cycling and pedestrian movement within the work zone along Wick Road and the parking lots.<br>.2 Payment for special procedures for traffic control and accommodation shall be made at the lump sum unit price tendered for this item. Payment will be made as follows, 25% for the first Progress Payment, equal distribution of 50% of payment for the intermediate progress payments, and 25% for the last Progress Payment.   |
| 1.5 References              | .1 BC Ministry of Transportation and Infrastructure Traffic Management Manual for Work on Roadways, latest edition.<br>.2 The 2012 Standard Specifications for Highway Construction.   |
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- 1.6 Protection of Public Traffic
- .1 Comply with current requirements of Acts, Regulations, and By-Laws for traffic regulation or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
  - .2 Do not leave equipment on traveled roadways overnight.
  - .3 Do not close driving or parking areas without consulting Departmental Representative. Before re-routing traffic erect signs and traffic control devices.
  - .4 Contractor shall be required to control traffic when falling timber within distances of roads, parking areas, or paths as specified by WorkSafe BC.
- 1.7 Informational and Warning Devices
- .1 Provide, erect, and maintain signs, flashing warning lights, and other devices required to indicate construction activities and other temporary and unusual conditions resulting from Project Work that requires road user response as specified in "Traffic Management Manual for Work on Roadways".
  - .2 All traffic and warning signs shall be bilingual. The English and French message shall be of equal size and at the same elevation, with English on the left and French on the right. Assistance in translation of construction and warning signs to French may be obtained from the Departmental Representative.
  - .3 Meet with Departmental Representative prior to commencement of Work to determine signs and other devices required for project.
- 1.8 Operational Requirements
- .1 Maintain existing conditions for traffic throughout period of Contract except when required for construction under Contract and when measures have been taken as specified herein and reviewed by Departmental Representative to protect and control public vehicle and pedestrian traffic.
  - .2 At the discretion of the Departmental Representative, the Contractor may be requested to modify the TMP to accommodate any irregularities or excessive congestion of traffic flow.
  - .3 Remove signs and barriers upon completion of the project.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 References
- .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 The Canadian Electric Code (as amended)
  - .4 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 CSA Z1006-10 Management of Work in Confined Spaces.
    - .5 CSA Z462- Workplace Electrical Safety Standard
  - 5 National Fire Code of Canada 2010 (as amended)
    - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
  - .6 American National Standards Institute (ANSI):
    - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
  - .7 Province of British Columbia:
    - .1 Workers Compensation Act, Part 3, Occupational Health and Safety.
    - .2 Occupational Health and Safety Regulation.
  - .8 Any Hazardous Materials Assessment Reports must be listed in this section
- 1.2 Related Sections
- .1 Refer to the following current Specification sections as required:
    - .1 Project Management: Section 01 31 19
    - .2 Construction Progress and Reporting: Section 01 32 17
    - .3 Submittal Procedures: Section 01 33 00
    - .4 Special Procedures for Traffic Control: Section 01 35 00
    - .5 Temporary Utilities: Section 01 51 00
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- .6 Construction Facilities: Section 01 52 00
  - .7 Temporary Barriers and Enclosures: Section 01 56 00
  
  - 1.3 Workers' Compensation Board Coverage
    - .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.
  
  - 1.4 Compliance with Regulations
    - .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
    - .1 Submit to Departmental Representative for review all submittals listed.
    - .2 Work affected by submittals shall not proceed until review(s) by Departmental representative is/are complete.
    - .3 Submit the following:
      - .1 Health and Safety Plan within 5 days after date of Notice to Proceed and prior to commencement of Work.
      - .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 On site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
    - .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 for review upon request.
    - .5 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:
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- .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 Assume responsibility as the Prime Contractor for Work under this Contract.
  - .2 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.
  - .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable federal, provincial, territorial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- 1.7 Health and Safety Coordinator
- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. The Health and Safety Coordinator must:
    - .1 Have site-related working experience.
    - .2 Have working knowledge of occupational Health and Safety regulations.
    - .3 Be responsible for completing all Health and Safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform Work.
    - .4 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
    - .5 Be on site during execution of work.
- 1.8 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.
- 1.9 Project/Site Conditions
- .1 Potential work hazards onsite include: overhead and buried electrical utilities, buried water mains, and local traffic.
  - .2 The Contractor is solely responsible for all utility detection and clearances prior to starting work.
  - .3 The Contractor will not rely solely upon the Contract Drawings or other information provided for utility locations.
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- 1.10 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.
  - 1.11 Work Permits
    - .1 Obtain permit(s) related to project before start of work.
  - 1.12 Filing of Notice
    - .1 The Contractor is to file Notice of Project with Provincial authorities prior to beginning of Work.
    - .2 Provide copies of all notices to the Department Representative.
  - 1.13 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.
        - .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.
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- .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment 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 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.
  - 1.14 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.
    - .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 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.
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- 1.15 Hazardous Products .1 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and provision of MSDSs acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
- .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00 – Submittal Procedures.
- 1.16 Electrical Safety Requirements .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
- .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with the Departmental Representative.
- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.
- 1.17 Fire Safety and Hot Work .1 Obtain Departmental Representative's authorization before any welding, cutting, straightening, or any other hot work operations can be carried out onsite.
- 1.18 Fire Safety Requirements .1 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.
- .2 Handle, store, use, and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
- 1.19 Unforeseen Hazards .1 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.
- 1.20 Posted Documents .1 Post legible versions of the following documents on site:
- .1 Health and Safety Plan.
- .2 Sequence of work.
- .3 Emergency procedures.
- .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
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- .5 Notice of Project.
- .6 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.
- .7 WHMIS documents.
- .8 MSDSs.
- .9 List of names of Joint Health and Safety Committee members, or Health and Safety Representative.
- .2 Post all MSDSs onsite, 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.
- 1.21 Meetings
  - .1 Schedule and administer a Health and Safety meeting with Departmental Representative prior to commencement of Work.
  - .2 Attend the Health and Safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
  - .3 Contractor to hold regular Health and Safety meetings onsite as required by applicable legislation.
  - .4 All Health and Safety documentation / meeting minutes completed by the Contractor are to be forwarded to the Departmental Representative.
- 1.22 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 issues identified.
  - .3 The Departmental Representative may issue a "stop work order" if non-compliance with 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**

- 1.1 Measurement for Payment .1 Payment for environmental procedures:
- .1 Payment for the Contractor to implement environmental procedures outlined in the Environmental Management Plan (EMP) as directed by the Environmental Monitor and the Departmental Representative will be at a “time and materials” basis and paid through a Contract Change Order with the exception of erosion control.
  - .2 The Contractor is required to provide and store, on-site, the “required equipment and supplies” as outlined in the EMP. Costs associated with the equipment and supplies will only be considered if/and when they are implemented.
  - .3 There will be no consideration for any other additional payment, including shut downs due to heavy rain events, for the Contractor other than Item 1.1.1.1 to implement the environmental procedures.
- .2 Payment for erosion control:
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supplying and placing of erosion control blanket on all exposed banks and surfaces as directed by the Environmental Monitor and the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: supply and installation of erosion control blanket and retaining staples or pins, if required, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the unit price for each square meter of erosion control blanket installed as measured and accepted by the Departmental Representative. Overlap to be considered incidental in the payment item.
- 1.2 References .1 Environmental management plan (EMP) entitled ”Environmental Management Plan - Wick Road and Kwisitit Visitor Centre Parking Lot Upgrades”, prepared by Current Environmental, dated January 25, 2017.
- 1.1 Definitions .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.
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- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .3 Invasive plants: are any alien plant species that have the potential to pose undesirable or detrimental impacts on humans, animals or ecosystems. Invasive plants have the capacity to establish quickly and easily on both disturbed and un-disturbed sites, and can cause widespread negative economic, social and environmental impacts.
- .4 Noxious weeds: are invasive plants that have been designated under the BC Weed Control Act. This legislation imposes a duty on all land occupiers to control a set list of identified invasive plants.  
[www.agf.gov.bc.ca/cropprot/noxious.htm](http://www.agf.gov.bc.ca/cropprot/noxious.htm)
- 1.2 Regulatory Overview .1 Comply with all applicable environmental laws, regulations and requirements of Federal, Provincial, and other regional authorities, and acquire and comply with such permits, approvals and authorizations as may be required.
- 1.3 Site Access and Parking .1 The Contractor shall park employee vehicles and equipment in an area designated by the Departmental Representative.
- 1.4 Erosion control .1 Erosion control measures that prevent sediment from entering any waterway, in the vicinity of the construction site.
- .2 Erosion control measures must be in compliance with both Federal and Provincial legislation and directives from the EMP where required. Contractors should be referencing the provincial MOE Standards and Best Practices for Instream Works (2004) for best management practices in sediment and erosion control during construction activities.
- 1.5 Pollution Control .1 The Contractor shall prevent any sediment, deleterious and objectionable materials from entering streams, rivers, wetlands, water bodies or watercourses that would result in damage to aquatic and riparian habitat. Hazardous or toxic products shall be stored no closer than 100 metres to any surface water.
- .2 The Contractor shall prevent blowing dust and debris by providing dust control for on-site work by methods that are approved by the Departmental Representative.
- .3 The Contractor shall provide spill kits, to the satisfaction of the Departmental Representative, at refueling, lubrication and repair locations that will be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order on the
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- construction site. The Contractor and site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- .4 Timely and effective actions shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The Departmental Representative shall be notified immediately of any spill as well as the provincial authorities.
- .5 In the event of a spill, the Contractor shall prioritize the clean-up and all other work shall be stopped, where appropriate, and personnel devoted to spill containment and clean up.
- .6 The costs involved in a spill incident (control, clean up, disposal of contaminants, and site remediation to pre-spill conditions), shall be the responsibility of the Contractor. The site will be inspected to ensure completion to the pre-spill condition to the satisfaction of the Departmental Representative.
- 1.6 Equipment Maintenance, Fueling and Operation .1 The Contractor shall ensure that all soil, seeds and any debris attached to construction equipment to be used on the project site shall be removed (e.g. power washing) outside before delivery to the work site.
- .2 Equipment fueling site will be identified by the Contractor to the satisfaction of the Departmental Representative. On site storage of fuel shall not be allowed.
- .4 Mobile fuel containers (e.g. slip tanks, small fuel carboys) shall remain in the service vehicle at all times.
- .5 Equipment use on the project shall be fueled with E10, and low sulphur diesel fuels where available, and shall conform to local emission requirements. The Contractor is to ensure that unnecessary idling of the vehicles is avoided.
- .6 Oil changes, lubricant changes, greasing and machinery repairs shall be performed at locations satisfactory to the Departmental Representative. Waste lubrication product (e.g. oil filters, used containers, used oil, etc.) shall be secured in spill-proof containers and properly recycled or disposed of at an approved facility. No waste petroleum, lubricant products or related materials are to be discarded, buried or disposed of in borrow pits, turnouts, picnic areas, viewpoints, etc. or anywhere within the work area.
- .7 The Contractor shall ensure that all equipment is inspected daily for fluid/fuel leaks and maintained in good working condition.
- .8 Fuel containers and lubricant products shall be stored only in secure locations to the satisfaction of the Departmental Representative. Fuel tanks or other potential deleterious substance containers shall be secured to ensure they are tamperproof and cannot be drained by vandals when left overnight. Alternatively, the Contractor may hire a security person employed to prevent vandalism.
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- 1.7 Operation of Equipment
- .1 Equipment movements shall be restricted to the “footprint” of the construction area.
  - .2 When, in the opinion of PWGSC, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the designated work area, the Contractor shall be responsible, at his or her expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc. to the satisfaction of the Departmental Representative.
  - .3 Restrict vehicle movements to the work limits.
- 1.8 Managing Invasive Plant Vegetation
- .1 Keep equipment clean and wash equipment prior to mobilization to site.
  - .2. Imported material must be free from vegetation and seeds.
  - .3 Only use clean road material from invasive plant-free borrow pits and quarries.
  - .4 Conduct an inspection of any fill material source to identify any potential invasive species issues.
- 1.9 Fire Prevention and Control
- .1 A fire extinguisher shall be carried and available for use on each machine.
  - .2 Construction equipment shall be operated in a manner and with all original manufacturers’ safety devices to prevent ignition of flammable materials in the area.
  - .3 Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented.
  - .4 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. The Departmental Representative shall be notified of any fire immediately as well as the applicable Provincial Authorities. Basic instruction and phone numbers will be provided on-site by the Contractor and will be discussed in the project start-up meeting.
  - .5 Fires or burning of waste materials is not permitted.
- 1.10 Relics and Antiquities
- .1 Artifacts, relics, antiquities, and items of historical interest such as cornerstones, commemorative plaques, inscribed tablets and any objects found on the work site that may be considered artifacts shall be reported to the Departmental Representative immediately. The Contractor and workers shall wait for instruction before proceeding with their work.
  - .2 All historical or archaeological objects found are protected under federal Acts and regulations. The Contractor and workers shall stop work and protect any articles found and request direction from the Departmental Representative.
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- 1.11 Waste Materials Storage and Removal .1 The Contractor and workers shall dispose of hazardous wastes in conformance with the applicable federal and provincial regulations.
- .2 All wastes originating from construction, trade, hazardous and domestic sources, shall not be mixed, but will be kept separate.
- .3 Construction, trade, hazardous waste and domestic waste materials shall be contained and removed and disposed of at an appropriate off site waste landfill.
- .4 A concerted effort shall be made by the Contractor and workers to reduce, reuse and recycle materials where possible.
- .5 Sanitary facilities, such as portable container toilets, shall be provided by the Contractor and maintained in a clean condition.
- 1.12 Wastewater Discharge Criteria .1 Wash water, contaminated groundwater, and/or any other liquid effluent stream will be released onto the ground at a location that is a minimum of 30 metres from natural drainage courses and will conform to the discharge requirements set out in the provincial Water Act Permit:
- .2 Contractor must obtain approval from the provincial Water Act Officer prior to discharging any treated wastewater.
- 1.13 Drainage .1 Provide temporary drainage as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- 1.14 Environment Protection Supplies .1 Comply with federal and provincial fisheries and environmental protection legislation, including preventing the loss or destruction of fish habitat, and minimizing the impact of sedimentation, siltation or otherwise causing a degradation in water quality.
- .2 Supply, transport, install and maintain erosion, sediment and drainage controls necessary to complete the Work in accordance with the requirements of Departmental Representative.
- .3 Provide inventory of environmental protection supplies prior to mobilization.

## PART 2 - PRODUCTS

- 2.1 Material .1 Erosion Control Blanket (ECB):
- .1 Composed of coconut fibres bound together with natural biodegradable netting.
- .2 Supplied in rolls.
- .3 Mass/Unit Area, minimum 322g/m<sup>2</sup>.
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- .4 Tensile strength to ASTM D6818, minimum MD of 4.5kN/m and CD of 3.6kN/m.
- .5 Elongation to ASTM D6818, 20% / 20%
- .6 Based on general physical properties outlined above, the equivalent ECB would be Layfield EG-2C (NN).

### PART 3 - EXECUTION

#### 3.1 Installation

- .1 Prepare subgrade by grading to provide a smooth, uniform surface. Remove all stumps, large rock, brush or other debris that could damage the fabric. Fill all holes and depressions so that the fabric does not bridge them. Replace loose or unstable soils.
- .2 Place erosion control blanket on all exposed surfaces.
- .3 Dig a 150mm x 150mm anchor trench both upslope and downslope of the area to be covered.
- .4 Secure the blanket with staples or pins into the trench every 300mm and backfill and compact.
- .5 Roll the blankets vertically down the slope or in the direction of the of flow for channels in a loose fashion and free of tension stress, folds, wrinkles and creases.
- .6 Overlap blankets a minimum 150mm in accordance with manufacturer's recommendations with downslope blanket underneath upslope blanket to form a shingle pattern.
- .7 Staple the blanket at 600mm x 600mm spacing in accordance with the manufacturer's recommendations. Pattern may differ for steeper slopes.
- .8 Replace damaged or deteriorated blanket to approval of Departmental Representative.

#### 3.2 Protection

- .1 No vehicles permitted directly on the erosion control blanket.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Quality Control Plan .1 Prepare and submit to Departmental Representative for review and approval a Quality Control Plan in accordance with Section 01 33 00 – Submittal Procedures, prior to project startup.
- 1.2 Measurement for Payment .1 No separate payment will be made for quality assurance, surveying, and testing. Payment for quality control is considered as incidental to the work and to be included in the relevant unit prices in this contract.
- 1.3 Inspection .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- 1.4 Independent Inspection Agencies .1 Appoint and pay for services of third-party Independent Quality Assurance testing laboratory and field staff including as follows:
- .1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.
- .2 Inspection and testing performed for Contractor's convenience.
- .3 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
- .4 Additional tests at the rates specified as follows:
- .1 Granular Base
- .1 Compaction: 1 test / 250 m<sup>2</sup>
- .2 Sieve: 1 test / material source / 1000 m<sup>3</sup>
- .2 Granular Sub-Base
- .1 Compaction: 1 test / 250 m<sup>2</sup>
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- .2 Sieve: 1 test / material source / 1000 m<sup>3</sup>
      - 3. Culvert Trench Backfill
        - .1 Compaction: 1 test / trench
    - .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
    - .3 Provide equipment required for inspection and testing by appointed agencies.
    - .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
    - .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.
  - 1.5 Access to Work
    - .1 Allow inspection/testing agencies access to Work.
    - .2 Cooperate to provide reasonable facilities for such access.
  - 1.6 Procedures
    - .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
    - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
    - .3 Provide labour and facilities to obtain and handle samples and materials onsite. Provide sufficient space to store test samples.
  - 1.7 Rejected Work
    - .1 Remove defective Work, whether result of poor workmanship, use of defective products, or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
    - .2 Make good other Contractor's work damaged by such removals or replacements promptly.
    - .3 If in opinion of the Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the Departmental Representative may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, with the amount determined by the Departmental Representative.
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- 1.8 Surveys
- .1 The Contractor shall be responsible for all layout and construction survey to complete the work.
  - .2 The Contractor shall submit a red line as-built drawing of the work to the Departmental Representative upon completion of the work. An electronic as-built survey will be acceptable in place of a red line drawing.
- 1.9 Reports
- .1 Submit 1 copy of inspection and test reports to Departmental Representative with all progress reports or, generally, as reports become available.
  - .2 Provide copies to Subcontractor of Work being inspected or tested and to manufacturer or fabricator of material being inspected or tested.

**END OF SECTION**

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**PART 1 - GENERAL**

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|--|----|---|
| 1.1 Section Includes                   | .1 | Temporary utilities.  |
| 1.2 Installation and Removal           | .1 | Provide temporary utilities in order to execute Work expeditiously.   |
|  | .2 | Remove from site all such work after use.   |
| 1.3 Water Supply                       | .1 | Provide continuous temporary supply of potable water for construction use, if applicable.   |
|  | .2 | Remove or decommission temporary water supply facilities upon completion of project.  |
| 1.4 Sanitary Facilities                | .1 | Provide sanitary facilities for construction use.   |
|  | .2 | Remove temporary sanitary facilities upon completion of project.  |
| 1.5 Temporary Power and Light          | .1 | Provide and pay for temporary power during construction for temporary lighting and operating of power tools and for construction use.           |
|  | .2 | Arrange for connection with appropriate utility company or Departmental Representative. Pay all costs for installation maintenance and removal. |
| 1.6 Temporary Communication Facilities | .1 | Provide and pay for temporary telephone necessary for own use.  |
| 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 onsite.   |

**END OF SECTION**

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**PART 1 - GENERAL**

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|-------------------------------------|----|---|
| 1.1 Section Includes                | .1 | Construction access and parking.  |
| 1.2 Installation and Removal        | .1 | Provide construction facilities in order to execute work expeditiously.   |
|                                     | .2 | Remove from all sites all such facilities after use.  |
| 1.3 Site Storage                    | .1 | Confine Work and operations of employees to only that which is required by the Contract Documents.  |
|                                     | .2 | Do not unreasonably encumber premises with products.  |
| 1.4 Construction Access and Parking | .1 | Parking will be permitted onsite provided it does not disrupt performance of Work.  |
|                                     | .2 | Provide and maintain adequate access to project site.   |
|                                     | .3 | Existing roads and temporary access roads will be used for access to the project site. Maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.  |
| 1.5 Sanitary Facilities             | .1 | Provide sanitary facilities for work force in accordance with governing regulations and ordinances.   |
|                                     | .2 | Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.   |
| 1.6 Construction Signage            | .1 | Signs and notices for health, safety, traffic control, instruction, etc. shall be in both official languages unless symbolic in nature. See Sections 01 35 33, Health and Safety, and 01 35 00, Special Procedures for Traffic Control, of these Specifications for more information. |
|                                     | .2 | Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.  |
|                                     | .3 | No other signs or advertisements, other than those required in the contract, shall be permitted within the park boundary.   |

**END OF SECTION**

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**PART 1 - GENERAL**

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|---|----|--|
| 1.1 Section Includes                            | .1 | Barriers.  |
|   | .2 | Traffic Controls.  |
| 1.2 Installation and Removal                    | .1 | Provide temporary controls in order to execute Work expeditiously.   |
|   | .2 | Remove from all sites all such work after use.   |
| 1.3 Protection for Trees                        | .1 | Protect trees and plants designated to remain. Protect from damage by equipment and construction procedures.                                       |
|   | .2 | Replace any trees designated for saving in kind that are damaged during construction.  |
| 1.4 Access to Site                              | .1 | Maintain existing access roads required for access to Work.  |
| 1.5 Public Traffic Flow                         | .1 | Provide and maintain competent signal flag operators, traffic signals, barricades and flashers as required to perform Work and protect the public. |
| 1.6 Fire Routes                                 | .1 | Maintain access to property for use by emergency response vehicles.  |
| 1.7 Protection for Off-Site and Public Property | .1 | Protect surrounding private and public property from damage during performance of Work.  |
|   | .2 | Be responsible for damage incurred.  |
| 1.8 Protection of Structure Finishes            | .1 | Provide protection for existing structures during performance of Work.   |
|   | .2 | Be responsible for damage incurred due to lack of or improper protection.  |

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Products and Materials
- .1 Use new products and materials unless otherwise specified.
  - .2 Use products of one manufacturer for material of the same type or classification unless otherwise specified.
  - .3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
  - .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.
  - .5 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.
  - .6 Prevent damage, adulteration, and soiling of products during delivery, handling, and storage. Immediately remove rejected products from site.
  - .7 Store products in accordance with suppliers' instructions.
  - .8 Touch-up damaged finished surfaces to Departmental Representative's satisfaction.
  - .9 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- 1.2 Quality of Products
- .1 Products, materials, and articles (referred to as products throughout Specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source, and quality of Products provided.
  - .2 Defective products will be rejected regardless of previous inspections.
    - .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
    - .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
  - .3 Retain purchase orders, invoices, and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
  - .4 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
  - .5 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the site.
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- 1.3 Availability of Products .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.
- .3 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.
- 1.4 Manufacturer's Instructions .1 Unless otherwise indicated in Specifications, install or erect products in accordance with manufacturer's instructions.
- .1 Do not rely on labels or enclosures provided with products.
- .2 Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between Specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- .4 Provide Manufacturer's instructions and specifications to Departmental Representative for review prior to any installations.
- 1.5 Contractor's Options .1 Products are specified by "Prescriptive" specifications: select any for Selection of product meeting or exceeding specifications. Products for Tendering
- .2 Products specified under "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
- .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Products. Alternative products may be considered provided full technical data is received in writing by Departmental Representative.
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- .5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.
- 1.6 Substitution After Contract Award
- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
- .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by the Departmental Representative if:
- .1 products selected by tenderer from those specified are not available;
- .2 delivery date of products selected from those specified would unduly delay completion of Contract, or
- .3 alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
- .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the Project. Pay for design or drawing changes required as result of substitution.
- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.
- 1.7 Transportation
- .1 Pay costs of transportation of products required in performance of Work.
- 1.8 Quality of Work
- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.
- 1.9 Coordination
- .1 Ensure cooperation of workers during Work. Maintain efficient and continuous supervision.
-

- 1.10 Remedial Work
- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
  - .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

## PART 2 - PRODUCTS

- 2.1 Acceptable Products
- .1 Submit product data sheets for all manufactured products used in the Work to Departmental Representative for review in accordance with Section 01 33 00, Submittal Procedures.
  - .2 Use best quality products.

**END OF SECTION**

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**PART 1 - GENERAL**

- |                         |    |   |
|-------------------------|----|---|
| 1.1 Section Includes    | .1 | Progressive cleaning.   |
|                         | .2 | Final cleaning.   |
| 1.2 Project Cleanliness | .1 | Maintain Work in tidy condition, free from accumulation of waste products and debris.   |
|                         | .2 | Remove waste materials from sites at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials onsite.  |
|                         | .3 | Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.  |
|                         | .4 | Ensure that no evasive species of vegetation are brought into the Park or are transported from one location to another within the Park. Make arrangements to provide only uncontaminated products for use. This may include using washed materials or materials using only clean blast rock. Machinery and equipment shall be thoroughly cleaned before moving between locations. |
| 1.3 Final Cleaning      | .1 | When Work is Substantially Performed, remove surplus products, tools, construction machinery, and equipment not required for performance of remaining Work.   |
|                         | .2 | Remove all waste products and debris.   |
|                         | .3 | Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.  |

**END OF SECTION**

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**PART 1 - GENERAL**

- |                                |    |   |
|--------------------------------|----|---|
| 1.1 Section Includes           | .1 | Waste Management Work Plan.   |
| 1.2 Definitions                | .1 | Waste Management Coordinator (WMC): Designate individual who is in attendance onsite full-time. Designate, or have designated individuals from each Subcontractor to be responsible for waste management related to their trade and for coordinating activities with WMC. |
|                                | .2 | Waste Audit (WA): Relates to projected waste generation. Involves measuring and estimating quantity and composition of waste, reasons for waste generation, and operational factors that contribute to waste.   |
|                                | .3 | Waste Reduction Workplan (WRW): Written report that addresses opportunities for reduction, reuse, or recycling of materials.  |
|                                | .4 | Materials Source Separation Program (MSSP): consists of a series of ongoing activities to separate reusable and recyclable waste materials into material categories from other types of waste at point of generation.   |
| 1.3 Documents                  | .1 | Maintain at the job site one copy of following documents:<br>.1 Waste Management Workplan.  |
| 1.4 Use of Site and Facilities | .1 | Locate waste, refuse, recycling, etc. containers in locations to facilitate deposit of materials without hindering daily operations.  |
|                                | .2 | Locate separated materials in areas which minimize material damage.   |
| 1.5 Submittal                  | .1 | Submit requested submittals in accordance with Section 01 33 00, Submittal Procedures.  |
|                                | .2 | Prepare and submit the following submittals within 7 days of the Award of Contract:<br>.1 Submit 3 copies of completed Waste Management Workplan (WMW).   |
|                                | .3 | Provide Departmental Representative with receipts indicating quantity of material delivered to landfill.  |
|                                | .4 | Provide Departmental Representative with receipts indicating quantity and type of materials sent for recycling.   |
| 1.6 Waste Management Workplan  | .1 | Structure WMW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.   |
|                                | .2 | Describe management of waste.   |
|                                | .3 | Identify opportunities for reduction, reuse, and/or recycling (3Rs) of materials.   |
-

- .4 Post workplan or summary where workers at site are able to review its content.
- 1.7 Waste Processing Sites .1 Provide waste processing sites as applicable within the Province of British Columbia to Departmental Representative within 14 days of the Award of Contract.
- 1.8 Disposal of Wastes .1 Burying of rubbish and waste materials is prohibited unless approved by Departmental Representative at off-site locations obtained by the Contractor.  
.2 Burning of rubbish and waste materials is prohibited unless permitted by British Columbia Ministry of Forests. Permit to be obtained by the Contractor.  
.3 Disposal of waste volatile materials, mineral spirits, oil, paint thinner, etc. into waterways or by dumping onsite is prohibited.
- 1.9 Storage and Handling .1 Store, materials to be reused, recycled, and salvaged in locations obtained by the Contractor and accepted by Departmental Representative.  
.2 Unless specified otherwise, materials for removal become Contractor's property.
- 1.10 Scheduling .1 Coordinate work with other activities at site to ensure timely and orderly progress of the Work.

## PART 2 – EXECUTION

- 2.1 Application .1 Do work in compliance with the WMW.  
.2 Implement MSSP for waste generated on Project in compliance with approved methods and as approved by Departmental Representative.  
.3 Materials must be immediately separated into required categories for reuse or recycling.  
.4 Materials in separated condition: collect, handle, store onsite, and transport off-site to an approved and authorized recycling facility.  
.5 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
  - 2.2 Cleaning .1 Remove tools and waste materials on completion of work, and leave work area in clean and orderly condition.  
.2 Cleanup work area as work progresses.  
.3 Source separate materials to be reused/recycled into specified sort areas.
-

- 2.3 Diversion of Materials
- .1 Create a list of materials to be separated from the general waste stream and stockpiled in separate containers, to the approval of the Departmental Representative and consistent with applicable fire regulations.
    - .1 Mark containers.
    - .2 Provide instruction on disposal practices.
  - .2 Onsite sale of salvaged, recovered, reusable, recyclable, etc. materials is not permitted.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Administrative procedures preceding preliminary and final reviews of Work and Final Payment.
- 1.2 Inspection and Declaration .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
- .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
- .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Review: Departmental Representative and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Engineer's Review: Engineer, Departmental Representative, and Contractor will perform review of Work to identify if Work has been completed according to the requirements of the Contract Documents. Contractor shall correct Work accordingly.
- 1.3 Construction Completion Certificate .1 Once the Contractor has completed all Work and correction of deficiencies, he shall submit written certification to the Departmental Representative that
- .1 Contract Documents have been reviewed.
- .2 Work has been completed and inspected for compliance with Contract Documents.
- .3 Defects have been corrected and deficiencies have been completed.
- .4 Work is complete and ready for Final Review.
- .1 Final Review: when items noted above are completed, request final review of Work by Departmental Representative. If Work is deemed incomplete by Departmental representative, complete outstanding items and request another review.
- .2 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Certificate of Substantial Performance.
- 1.4 Close-Out Submittals .1 Project Record Documents as specified in Section 01 33 00.
- .2 As-Built Documents as specified in Section 01 11 00.
-

- .3 Guarantees and Warranties:
    - .1 In addition to guarantee requirements contained elsewhere in the Contract Documents to which all Work of this Contract is to be guaranteed for one (1) year after the date of issue of the Construction Completion Certificate by the Departmental Representative.
    - .2 Upon completion of the Work, furnish to the PWGSC a guarantee in writing, stating that the Contractor will make good, at their expense, and to the satisfaction of the Departmental Representative, all defects that may develop in materials and equipment used on the Work for a minimum period of one (1) year from date of Construction Completion Certificate, upon PWGSC assuming custody, that are in the opinion of the Departmental Representative due to the use of improper workmanship and faulty materials and equipment.
    - .3 The Contractor is to, in the case of Work Performed by their Subcontractors and when guarantees are required, secure such guarantees from the Subcontractor and furnish them to PWGSC on or before the final completion of the Work.
    - .4 The guarantees are to provide that all Work furnished and installed by the guarantors are to remain in like new condition and working order for the period of one (1) year and that the guarantors will replace same with new and like materials at no expense to PWGSC unless it can be proven that the defects are caused by abuse and negligence on the part of PGWSC or its employees.
    - .5 It is to be understood that in effecting the replacement, the Contractor or Subcontractor responsible is to also bear all Costs involved in removing or replacing adjacent affected materials.
    - .6 One (1) month prior to expiry of guarantee period, the Departmental Representative will carry out a detailed inspection of the Project.
    - .7 Any defect apparent will be noted and will be forwarded to the Contractor in writing for correction under the terms of the Contract with no additional cost to PWGSC.
  - .4 Commencement of Guarantee and Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date of commencement for warranty periods.
-



## 1.5 Final Payment

- .1 Final Payment: When Departmental Representative considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request final review.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Removal and/or demolition of culverts.  
.2 Removal of structures.  
.3 Abandonment and/or removal of piping.
- 1.2 Payment Procedure .1 The unit prices bid for this item shall be full compensation for the removal, demolition and abandonment of all items identified on the Drawings and as directed by the Departmental Representative.  
.2 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities. Backfill and reinstatement to be considered incidental in the payment item.
- 1.3 References .1 Canadian Standards Association (CSA International).  
.1 CSA S350-M1980(R1998), Code of Practice for Safety in Demolition of Structures.  
.2 Canadian Environmental Assessment Act (CEAA)  
.3 Canadian Environmental Protection Act (CEPA)  
.1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.  
.4 Transportation of Dangerous Goods Act (TDGA)  
.2 Comply with National Building code of Canada, Part 8, "Safety Measures at Construction and Demolition Sites", and Provincial requirements.
- 1.4 Storage and Protection .1 Perform all work in accordance with Section 01 35 43 – Environmental Protection.  
.2 Protect in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling, and Section 31 24 13 – Roadway Excavation Embankment and Compaction.  
.3 Protect existing items designated to remain. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to the Contract.  
.4 In all circumstances, ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.  
.5 Do not dispose of waste of volatile materials such as, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses. Ensure disposal procedures are in accordance with the Waste Management Workplan and to the satisfaction of the
-

- Departmental Representative.
- .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
- .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities, and the EASR.
- .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
- 1.5 Regulatory Requirements .1 Ensure all work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable provincial regulations.

## PART 2 - PRODUCTS

- 2.1 Equipment .1 Equipment and heavy machinery used to meet or exceed all applicable emission requirements.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

## PART 3 - EXECUTION

- 3.1 Preparation .1 Review site with Departmental Representative and verify extent and location of items designated for removal, disposal, abandonment and items to remain.
- 3.2 Sequences of Operation .1 Removal:  
.1 Remove items as indicated.  
.2 Do not disturb items designated to remain in place.
- .2 Backfill:  
.1 Backfill in areas as indicated and in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling.
- 3.3 Restoration .1 Restore areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.
- .2 Use only soil treatments and procedures that are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.
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- 3.4 Cleanup .1 Upon completion of work, remove debris, trim surfaces and leave work site clean, neat and tidy.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment .1 All materials, labour, equipment, and services necessary for any toxic waste removal of existing materials shall be paid as a Change Order to this Contract.
- 1.2 References .1 Canadian Environmental Protection Act, CEPA.  
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).  
.1 Material Safety Data Sheets (MSDS)  
.3 National Fire Code of Canada latest edition.  
.4 Transportation of Dangerous Goods Act (TDG Act).  
.5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).
- 1.3 Definitions .1 Toxic: For the purposes of this specification, a substance is considered toxic if it is listed on the Toxic Substances List found in Schedule 1 of CEPA.  
.2 List of Toxic Substances: found in Schedule 1 of CEPA, lists all substances that have been assessed as toxic. The federal government can make regulations with respect to a substance specified on the List of Toxic Substances. Column II of this List identifies the type of regulation applicable to each substance.
- 1.4 Submittals .1 Product Data:  
.1 Submit photocopies of shipping documents and waste manifests to Departmental Representative when shipping toxic wastes off-site.  
.2 Maintain 1 copy of product data in a readily accessible file onsite.  
.2 Submission Requirements:  
.1 Submit product data to Departmental Representative in accordance with Section 01 33 00, Submittal Procedures.  
.2 Express all weights and volumes in SI Metric units.  
.3 Accompany submissions with a transmittal letter containing:  
.1 Date.  
.2 Project title and number.  
.3 Contractor's name and address.  
.4 Identification and quantity of attached product data.  
.5 Other pertinent data.
-

- 1.5 Storage and Handling
- .1 Store and handle toxic wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
  - .2 Store and handle flammable and combustible wastes in accordance with current National Fire Code of Canada requirements.
  - .3 Coordinate storage of toxic wastes with Departmental Representative and abide by internal requirements for labeling and storage of wastes.
  - .4 Observe smoking regulations at all times. Smoking is prohibited in any area where toxic wastes are stored, used, or handled.
  - .5 Report spills or accidents involving toxic wastes immediately to Departmental Representative and to appropriate regulatory authorities within 24 hours of incident. Take all reasonable measures to contain the release while ensuring health and safety is protected.
  - .6 Transport toxic wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
  - .7 Use only an authorized/licensed carrier to transport toxic waste.
  - .8 Coordinate transportation and disposal of toxic wastes with Departmental Representative.
- 1.6 Waste Management and Disposal
- .1 Dispose of toxic wastes generated onsite in accordance with applicable federal and provincial acts, regulations, and guidelines.
  - .2 Ensure toxic waste is shipped to an authorized/licensed treatment or disposal facility and that all liability insurance requirements are met.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 References
- .1 Canadian Environmental Protection Act, CEPA.
    - .1 Export and Import of Hazardous Waste Regulations (EIHW Regulations), SOR/2002-200.
    - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
      - .1 Material Safety Data Sheets (MSDS)
    - .3 National Fire Code of Canada.
    - .4 Transportation of Dangerous Goods Act (TDG Act) 1999, (c.34).
    - .5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).
- 1.2 Definitions
- .1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets the hazard criteria established in Transportation of Dangerous Goods Regulations.
  - .2 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.
  - .3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment, or disposal.
- 1.3 Submittals
- .1 Submit product data in accordance with Section 01 33 00, Submittal Procedures.
  - .2 Submit to Departmental Representative current MSDSs for each hazardous material required prior to bringing it/them onsite.
  - .3 Submit a hazardous materials management plan to Departmental Representative that identifies all hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.
- 1.4 Storage and Handling
- .1 Coordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labeling and storage of materials and wastes.
  - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
  - .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
-

- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene, and naphtha for ready use. Store all flammable and combustible liquids in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
  - .5 Transfer of flammable and combustible liquids will not be carried out in the vicinity of open flames or any type of heat-producing devices.
  - .6 Flammable liquids having a flash point below 38 degrees Celsius, such as naphtha or gasoline will not be used as solvents or cleaning agents.
  - .7 Store flammable and combustible waste liquids for disposal in approved containers located in a safe, ventilated area. Keep quantities to an absolute minimum.
  - .8 Observe smoking regulations at all times. Smoking is prohibited in any area where hazardous materials are stored, used, or handled.
  - .9 Abide by the following storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids and 5 litres for liquids:
    - .1 Store hazardous materials and wastes in closed and sealed containers which are in good condition.
    - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
    - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
    - .4 Segregate incompatible materials and wastes.
    - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
    - .6 Store hazardous materials and wastes in a secure storage area with controlled access.
    - .7 Maintain a clear egress from storage area.
    - .8 Store hazardous materials and wastes in a manner and location which will prevent them from spilling into the environment.
    - .9 Have appropriate emergency spill response equipment available near the storage area, including personal protective equipment.
    - .10 Maintain an inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
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- .11 Ensure personnel have been trained in accordance with WHMIS requirements.
  - .12 Report spills or accidents involving toxic wastes immediately to Departmental Representative and to appropriate regulatory authorities within 24 hours of incident. Take all reasonable measures to contain the release while ensuring health and safety is protected.
- 1.5 Transportation
- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
  - .2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.
  - .3 If hazardous waste is generated onsite:
    - .1 Coordinate transportation and disposal with Departmental Representative.
    - .2 Ensure compliance with applicable federal, provincial, and municipal laws and regulations for generators of hazardous waste.
    - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
    - .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
    - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
    - .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
    - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
    - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.
    - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
-

**PART 2 - PRODUCTS**

- 2.1 Materials
- .1 Only bring onsite the quantity of hazardous materials required to perform Work.
  - .2 Maintain MSDSs in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

**PART 3 – EXECUTION**

- 3.1 Disposal
- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
  - .2 Recycle hazardous wastes for which there is an approved, cost-effective recycling process available.
  - .3 Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities.
  - .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
  - .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, the environment in general, or in municipal solid waste landfills is prohibited.
  - .6 Dispose of hazardous wastes in a timely fashion in accordance with applicable provincial regulations.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurements for Payment .1 Payment for precast concrete no-post barrier:
- .1 Shall be full compensation for all work necessary and incidental for supply and installation of all concrete precast units of types and sizes indicated to lines, grades and cross section in accordance with the Drawings and as directed by the Departmental Representative.
  - .2 Measurement for payment for this item shall be at the unit price for each lineal metre of barrier installed, as measured and accepted by the Departmental Representative
- .2 Payment for precast concrete pipe headwalls shall be included in the lump sum unit price tendered for the individual culvert at the locations indicated on the Contract Drawings.
- .3 Payment for concrete pull boxes shall be included in the lump sum unit price tendered for the fiber optic communications at the locations indicated on the Contract Drawings
- 1.2 References .1 Canadian Standards Association (CSA International)
- .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- 1.3 Design Requirements .1 Design precast elements within a travelled surface to be designed to carry H20 traffic loads as specified and in accordance with applicable codes.
- 1.4 Submittals .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

**PART 2 - PRODUCTS**

- 2.1 Materials .1 Precast concrete units to be constructed in accordance with CAN/CSA-A23.1 unless otherwise stated.
-

**PART 3 -EXECUTION**

- 3.1 General
- .1 Install precast concrete units, including surface tolerances, finishing and field quality control, in accordance with the Contract Documents.
  - .2 Protection, storage and handling of precast concrete units to Manufacturer's recommendations.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Related Sections
- .1 Excavation, Trenching and Backfilling to Section 31 23 33
  - .2 Aggregates to Section 31 05 16
  - .3 Horizontal Directional Drilling to Section 33 34 01
- 1.2 Measurement for Payment
- .1 The unit price bid for this item shall be full compensation for all work necessary and incidental for the supply, installation, testing and commissioning of the fiber optic communications, as indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The bid price shall include but not be limited to: supply and installation of underground conduits, pull boxes including excavation, trenching, bedding, backfill and compaction and/or directional drilling; supply, install and test fiber optic cables; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities
- 1.3 Permits, Fees and Inspection
- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
  - .2 Pay associated fees.
  - .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
  - .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
  - .5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative
- 1.4 Submittals
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit manufacturers' literature for fiber optic cable and termination systems, indicating compliance with specifications.
  - .3 Contractor shall submit shop drawings in electronic format for the Departmental Representative's review.
  - .4 Shop drawings means technical data specifically prepared for the work of this Contract including: drawings, diagrams, data sheets, templates, spec sheets, schedules, calculations, instructions, and similar information not printed in standard form.
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- .5 Present shop drawings in clear and thorough manner to appropriately illustrate the work. Shop drawings are required for all equipment and accessories to be installed as part of this work.
  - .6 Identify field dimensions on the drawings.
  - .7 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable catalogue and brochure material. Do not assume catalogues are available in the Department Representative's office. Maintenance manuals and operating manuals are not suitable submittal material.
  - .8 Clearly mark materials with arrows, circles, clouds and underline marks. Cross-out non-applicable sections.
  - .9 Include technical data such as dimensions, performance with sufficient detail to allow the Engineer to verify the suitability of the material or equipment.
  - .10 Installed materials shall meet the requirements of the shop drawings irrespective of whether or not the Departmental has reviewed the shop drawings.
  - .11 Do not order materials or equipment until the engineer has reviewed and returned the shop drawings.
  - .12 Departmental Representative's review of shop drawings does not alleviate the Contractor for errors or omissions, nor deviations from the Contract documents.
- 1.5 Delivery and Storage
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Store materials off ground and in accordance with manufacturer's recommendations.
  - .4 All equipment shall be adequately protected from damage and from dust, dampness or any other injurious substance during delivery to the site, while stored at the site and after construction.
  - .5 Equipment stored in unheated or open areas on the site shall be covered and provided with thermostatically controlled heaters of sufficient size to keep the temperature of the equipment above the dew point.
  - .6 Electrical equipment shall not be installed until the room in which they are to be installed is completely free of any dust, dirt, dampness, construction debris or any other contaminants that might affect the future operation of the electrical equipment.
  - .7 Replace defective or damaged materials with new.
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- 1.6 Waste Management and Disposal
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
  - .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- 1.7 Field Quality Control
- .1 Carry out tests in presence of Departmental Representative.
  - .2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
  - .3 Submit test results for Departmental Representative's review.
- 1.8 Closeout Submittals
- .1 Provide record drawings, including lists of equipment and maintenance and operating manuals in accordance with Section 01 77 00 - Closeout Submittals.
    - .1 Include three complete bound sets of typewritten or printed instructions, covering the proper method of maintaining and operating all the communication systems included in this Contract.
    - .2 Manuals shall also include all shop drawings, catalogue numbers of all electrical equipment installed and manufacturer's parts lists, manufacturer's O&M manuals, drawings and installation leaflets for all equipment.

## PART 2 – PRODUCTS

- 2.1 Material and Equipment
- .1 Supply equipment as indicated by the drawings and specifications. Other materials may be substituted by the Contractor provided that such substitutions have been approved by the Departmental Representative prior to installation.
  - .2 All equipment and materials shall be new and shall bear a certification mark (CSA, ULc, ETL, etc.) that is acceptable to the BC Safety Authority.
  - .3 Factory-assemble control panels and component assemblies. Finished control panels and component assemblies shall bear a certification mark (CSA, ULc, ETL, etc.) that is acceptable to the BC Safety Authority.
  - .4 Shop drawings shall be submitted for major electrical items.
  - .5 When submitting shop drawings, the Contractor shall notify the Departmental Representative in writing of changes made therein from the electrical drawings and specifications.
-

- 2.2 Equipment Identification
1. Identify electrical equipment with nameplates as follows: Lamacoid 3mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws.
  - .2 Identification to be English.
- 2.3 Wiring Identification
1. Use colour coded wires in communication cables, matched throughout system.
- 2.4 Manufacturer's and CSA Labels
1. Visible and legible after equipment is installed.
- 2.5 Warning Signs
1. As specified and to meet requirements of Electrical Inspection Department and Department Representative.
  - .2 Decal signs, minimum size 175 x 250 mm.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Related Sections .1 Section 27 05 26 - Grounding and Bonding for Communications Systems.
- .2 Section 27 11 19 - Communication Terminal Blocks and Patch Panels.
- 1.2 Measurement for Payment .1 No measurement for payment will be made under this Section.
- 1.3 References .1 EIA-TIA Fiber Optic Standards including ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard and ANSI/TIA/EIA-590-A, Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant.
- .2 IEC Standards International.
- .3 The Fiber Optic Association, Inc.
- .4 BICSI Reference Standards for Outside Plant Installations.
- 1.4 Submittals .1 Submittals in accordance with Section 27 05 01 – Common Work Results - Communications.
- 1.5 Certification .1 Fiber optic cable shall be tested, certified and labeled for conformance with CAN/CSA-ISO/IEC Standards, EIA-445 Fiber Optic Test Procedures (FOTPs) (These are commonly known as "FOTPs" but are officially called "EIA-455-x, e.g. EIA-455-34 is FOTP-34) and in accordance with, ULC, or other certification program accredited by Standards Council of Canada.
- 1.6 Delivery, Storage and Handling .1 Store to protect materials from wind, moisture, sunlight and accidental ignition.
- .2 Install fiber optic cable during dry weather conditions.
- 1.7 Waste Management and Disposal .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

**PART 2 - PRODUCTS**

- 2.1 Materials .1 Fiber Optic Cable
- .1 Loose tube, gel filled, single mode fiber optic cable. Fiber counts as defined on the associated drawings.
- .2 Install 8.3/125 micron single-mode fiber optic cable to support data communication services.
-

- .3 Outside plant cable shall be used for all applications where cable is to be run in underground conduits. Outside plant cable may not be used for interior applications and shall meet the following specifications:
  - .1 Gel filled buffer tube, 250 um, acrylate.
  - .2 EIA/TIA-598 color coding for fiber optic cable.
  - .3 Flooded core
  - .4 Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
  - .5 Capable of a minimum crush resistance of 850 lb./in.
- .4 Installed fiber must meet or exceed the following performance specifications:

Fiber cable types	Wavelength (nm)	Max. Attn. (dB/Km)
Single-mode,	1,310	0.35
Outside plant	1,550	0.2

### PART 3 - EXECUTION

- 3.1 Pre-Install Checklist
    - .1 Main point of contact/project manager selected.
    - .2 All permits available for inspection.
    - .3 Sites prepared.
    - .4 All components on site, inspected, security arranged if necessary.
    - .5 Relevant personnel notified.
    - .6 Safety rules posted on the job site(s) and reviewed with all supervisors and installation personnel.
  - 3.2 Receiving Fiber Optic Cabling and Equipment Onsite
    - .1 Fiber Optic equipment and components are subject to damage by improper handling and must be handled accordingly.
    - .2 When initially received on the job site all fiber optic components should be carefully inspected for damage and tested for continuity or loss if damage is suspected.
    - .3 Ensure that all components and parts have been shipped, received, match quantities ordered (e.g. fiber optic cable contains the number and type of fiber ordered and is the length ordered), and that any discrepancies or damaged goods are noted, the supplier notified and replaced as required.
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- .4 All equipment and cabling shall be stored in a clean and dry location, protected from harsh environments and extremes of cold and heat.
  - 3.3 Handling Fiber Optic Cables Onsite
    - .1 Handle reels of fiber optic cable with care. All reels, regardless of size or length, must have both ends of the cable available for the testing. A fiber tracer or visual fault locator and bare fiber adapters both ends of the cable available for the testing. A fiber tracer or visual fault locator and bare fiber adapters can be used for continuity testing.
    - .2 Move small, lightweight spools of fiber optic cable by hand. Move larger reels with appropriate lifting equipment or using two or more installers skilled in the moving operation.
    - .3 Lifting equipment shall only must reels with a matched set of slings or chokers, attached to an appropriately sized piece of pipe inserted into the hole in the center of the reel. Slings and chokers shall never be attached around the spooled area of the reel. The cable reels shall be moved carefully to avoid damage to the cable.
  - 3.4 Fire Stopping
    - .1 All telecommunications fire stopping shall comply with applicable codes and standards, including TIA/EIA 569-A-Annex A and NECA/BICSI 568-2001.
    - .2 All penetrations shall be protected by approved firestops. Fire stopping compounds and devices shall be used whenever a fire separation has been breached by an installation.
    - .3 In most geographical locals the breaching of a fire separation will require physical monitoring until it has been repaired.
    - .4 Check with the "Authority Having Jurisdiction" for specific requirements on the project before commencing work.
  - 3.5 Pulling Cable
    - .1 All fiber cable is to be protected within conduit. After installation, conduits are to be permanently labeled as containing fiber optic cable.
    - .2 All cable and conduit are to be fully supported throughout its entire run.
    - .3 At no time shall more than 400 pounds of tension be placed on any fiber cable while it is being pulled through tray or conduit. It is preferred that all fiber cable be pulled with hand power only. If power winches or mechanical advantage devices are used to pull cable, a tensionometer must be used to insure that maximum tension is not exceeded. Alternatively, a "mechanical fuse" rated at 350 pounds may be included in the linkage. Torsion shall be avoided by the use of a swivel at the cable end. While under tension, a minimum bend radius of 20 times the outside cable diameter will be maintained through the use of pulleys and sheaves where required. After pulling, no bend may have a radius, at rest, of less than 10 times the outside cable diameter.
  - 3.6 Labeling
    - .1 Each cable and inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the
-

- cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of “Service Vault Splice Case number—cable number”.
- .2 Each fiber optic strand shall be labeled with a unique identifier at the splice case in the junction box and at the Fiber Patch Panels. Connectors shall be labeled on the identifying sheets on the front of the splice case.
  - .3 Each fiber shall be labeled where it enters the back of the coupler panels. The identifier shall be in the format Cable # - tube- strand.
- 3.7 Testing
- .1 It is suggested that each individual fiber in a cable be tested with an OTDR for length and transmission anomalies while on the reel before installation.
  - .2 All single mode fiber strands shall be tested end-to-end for bi-directional attenuation: 1310 nm/1550 nm for single-mode fibers. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer’s instructions for the test set being utilized.
  - .3 Tests must ensure that the measured link loss for each strand does not exceed the “worst case” allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above, 2.1.1 and 2.2.1).
  - .4 After the cable is in place it shall be tested in the following manner:
    - .1 After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to CNS in the form of hard-copy printouts or photographs of screen traces.
    - .2 After termination and bulkhead mounting, each terminated fiber is to be tested for end-to-end loss with a power meter/light source. As above, results are to be recorded and supplied to CNS.
    - .3 The maximum allowable attenuation for any splice or termination is 0.3 dB.
  - .5 The contractor shall review all end faces of field terminated connectors with a fiber inspection scope following the final polish. Connector end faces with hackles, scratches, cracks, chips and or surface pitting shall be rejected and repolished or replaced if repolishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 200X for single-mode fiber.
  - .6 Any deviation from these test procedures must be approved in writing in advance by PWGSC.
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- 3.8 Report
- .1 Record results in tabular form.
  - .2 Segregate runs by service vault location and by type of cable.
  - .3 Report Submission:
    - .1 Submit three 3 reports printed on 215 mm x 280 mm white paper. Provide one copy with cerlox binding for systems administrator. Leave remaining copies unbound for insertion into O&M manuals.
    - .2 Submit report prepared in electronic form (spreadsheet).

**END OF SECTION**

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**PART 1 - GENERAL**

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|-----------------------------------|----|--|
| 1.1 Related Sections              | .1 | Section 27 05 13 –Communication Services.  |
|                                   | .2 | Section 27 11 19 - Communication Terminal Blocks and Patch Panels.   |
| 1.2 Basis of Payment              | .1 | No measurement for payment will be made under this Section.  |
| 1.3 References                    | .1 | EIA-TIA Fiber Optic Standards including ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard and ANSI/TIA/EIA-590-A, Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant. |
|                                   | .2 | IEC Standards International.   |
|                                   | .3 | The Fiber Optic Association, Inc.  |
|                                   | .4 | BICSI Reference Standards for Outside Plant Installations.   |
| 1.4 Submittals                    | .1 | Submittals in accordance with Section 27 05 01 – Common Work Results - Communications.   |
| 1.5 Delivery and Storage Handling | .1 | Store to protect materials from wind, moisture, sunlight and accidental ignition.  |
|                                   | .2 | Install fiber optic cable during dry weather conditions.   |
| 1.6 Waste Management and Disposal | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.  |
|                                   | .2 | Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.   |

**PART 2 - PRODUCTS**

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|---------------|----|--|
| 2.1 Materials | .1 | Stranded #6, AWG TWH, Green copper ground conductors. Single point ground system.  |
|               | .2 | Two-hole short-barrel single crimp lugs (T&B preferred), no-oxide paste, hex-head steel bolts and nuts, flat washers and lock washers. Splices to be avoided but “C” type compression connectors should be used. Do not use electric arc weld, solder joints or split bolt connectors. |
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**PART 3 - EXECUTION**

- 3.1 Pre-Install Checklist
- .1 Main point of contact/project manager selected.
  - .2 All permits available for inspection.
  - .3 Sites prepared.
  - .4 All components on site, inspected, security arranged if necessary.
  - .5 Relevant personnel notified.
  - .6 Safety rules posted on the job site(s) and reviewed with all supervisors and installation personnel.
- 3.2 Firestopping
- .1 All telecommunications fire stopping shall comply with applicable codes and standards, including TIA/EIA 569-A-Annex A and NECA/BICSI 568-2001.
  - .2 All penetrations shall be protected by approved firestops. Fire stopping compounds and devices shall be used whenever a fire separation has been breached by an installation.
  - .3 In most geographical locals the breaching of a fire separation will require physical monitoring until it has been repaired.
  - .4 Check with the “Authority Having Jurisdiction” for specific requirements on the project before commencing work.
- 3.3 Grounding and Bonding
- .1 Ground systems shall be designed as specified by the Canadian Electrical Safety Code (latest edition) and other applicable codes and standards (ANSI/TIA/EIA 607-A, NECA-BICSI-568-2001).
  - .2 Although most fiber optic cables are not conductive, any metallic hardware used in fiber optic cabling systems (such as wall-mounted termination boxes, racks, and patch panels) must be grounded.
  - .3 Conductive cables require proper grounding and bonding for applicable conductors.
  - .4 Ground conductors must be routed in a manner to minimize sharp bends. The objective minimum ground wire turning radius for leads up to #6AWG is 150 mm.
  - .5 All connections should be tight. However, do not over tighten to the point where threads are stripped. Follow manufacturers recommended torquing specifications.
  - .6 The point of connection to equipment and racks will be scraped to bare metal and have a coating of no-oxide paste applied. The point of connection may be at the top or bottom of the rack, depending on the routing of the ground cable. One connection is required to welded racks and a connection to each upright is required for bolted racks.
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- .7 Non-metallic conduit is required if conduit is needed to protect the grounding cable.
- .8 The metallic members of optical fibre cables entering buildings shall be grounded and have 75mm insulation gap as close to the point of entrance as practical.

**END OF SECTION**

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**PART 1 - GENERAL**

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|------------------------------------|----|--|
| 1.1 Related Sections               | .1 | Section 27 05 13 – Communication Services  |
|                                    | .2 | Section 27 05 26 – Grounding and Bonding for Communications Systems  |
| 1.2 Basis of Payment               | .1 | No measurement for payment will be made under this Section.  |
| 1.3 References                     | .1 | EIA-TIA Fiber Optic Standards including ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard and ANSI/TIA/EIA-590-A, Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant.   |
|                                    | .2 | IEC Standards International.   |
|                                    | .3 | The Fiber Optic Association, Inc.  |
|                                    | .4 | BICSI Reference Standards for Outside Plant Installations.   |
| 1.4 Submittals                     | .1 | Submittals in accordance with Section 27 05 01 – Common Work Results - Communications.   |
| 1.5 Certification                  | .1 | Fiber optic cable shall be tested, certified and labeled for conformance with CAN/CSA-ISO/IEC Standards, EIA-445 Fiber Optic Test Procedures (FOTPs) (These are commonly known as "FOTPs" but are officially called "EIA-455-x, e.g. EIA-455-34 is FOTP-34) and in accordance with, ULC, or other certification program accredited by Standards Council of Canada. |
| 1.5 Delivery, Storage and Handling | .1 | Store to protect materials from wind, moisture, sunlight and accidental ignition.  |
|                                    | .2 | Install fiber optic cable during dry weather conditions.   |
| 1.6 Waste Management and Disposal  | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.  |
|                                    | .2 | Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.   |
-

**PART 2 - PRODUCTS**

- 2.1 Materials
- .1 The terminal ends of all fibers cable strands shall be field connectorized with SC connectors. The connectors shall be mounted on bulkheads and installed in enclosures Termination of cables may be of several types including mechanical or fusion spliced pigtails. The choice of termination method must be cleared with the Department Representative prior to termination.
  - .2 Fiber cables are to be terminated in one of two types of enclosures. These may be either wall-mounted or rack-mountable stand-alone units for installation. The final choice of fiber organizer shall be cleared with the Owner Representative prior to installation.
  - .3 Enclosures shall facilitate sorting and organization of optical fiber splices between outside plant and indoor riser cables routed to cross connection equipment. Enclosures shall have various mounting options, be dust proof, water resistant, and constructed of aluminum, with a durable power-coating. Gasketed door shall offer maximum access to enclosure interior during installation and service, and have a lockable option for added security. Enclosures shall facilitate cable pass through to adjacent units. Enclosures shall be locking or cable of having locks installed.

**PART 3 - EXECUTION**

- 3.1 Pre-Install Checklist
- .1 Main point of contact/project manager selected.
  - .2 All permits available for inspection.
  - .3 Sites prepared.
  - .4 All components on site, inspected, security arranged if necessary.
  - .5 Relevant personnel notified.
  - .6 Safety rules posted on the job site(s) and reviewed with all supervisors and installation personnel.
- 3.2 Labelling
- .1 Each cable and inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of "Service Vault Splice Case number—cable number".
  - .2 Each fiber optic strand shall be labeled with a unique identifier at the splice case in the junction box and at the Fiber Patch Panels. Connectors shall be labeled on the identifying sheets on the front of the splice case.
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- .3 Each fiber shall be labeled where it enters the back of the coupler panels. The identifier shall be in the format Cable # - tube- strand.
- 3.3 Termination Standards
- .1 The terminal ends of all fibers cable strands shall be field connectorized with SC connectors. The connectors shall be mounted on bulkheads and installed in enclosures Termination of cables may be of several types including mechanical or fusion spliced pigtails. The choice of termination method must be cleared with the Owner Representative prior to termination.
  - .2 Fiber cables are to be terminated in one of two types of enclosures. These may be either wall-mounted or rack-mountable stand-alone units for installation. The final choice of fiber organizer shall be cleared with the Owner Representative prior to installation.
  - .3 Each enclosure shall be labeled with a machine made label with permanent black ink on a white background. Labels shall be in the format "SVSC\_NNNNN", with the letters, "NN", supplied on the drawings. In addition, each SVSC shall be labeled on the face plate with the identifiers of the cables it contains.
  - .4 At each end of the cable, sufficient slack (40 meters for pull boxes and 10 meters for fiber patch panels) shall be left to facilitate reasonable future relocation. Slack shall be mounted on walls or upper ladder racks according to the Owner Representative's direction.
- 3.4 Testing
- .1 It is suggested that each individual fiber in a cable be tested with an OTDR for length and transmission anomalies while on the reel before installation.
  - .2 All single mode and multi-mode fiber strands shall be tested end-to-end for bi-directional attenuation, 850 nm/1300 nm for multimode and 1310 nm/1550 nm for single mode fibers. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer's instructions for the test set being utilized.
  - .3 Tests must ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above, 2.1.1 and 2.2.1).
  - .4 After the cable is in place it shall be tested in the following manner:
    - .1 After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to CNS in the form of hard-copy printouts or photographs of screen traces.
    - .2 After termination and bulkhead mounting, each terminated fiber is to be tested for end-to-end loss with a power
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meter/light source. As above, results are to be recorded and supplied to CNS.

.3 The maximum allowable attenuation for any splice or termination is 0.3 dB.

.5 The contractor shall review all end faces of field terminated connectors with a fiber inspection scope following the final polish. Connector end faces with hackles, scratches, cracks, chips and or surface pitting shall be rejected and re-polished or replaced if re-polishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 200X for single mode fiber.

.6 Any deviation from these test procedures must be approved in writing in advance by the Department Representative.

### 3.5 Report

.1 Record results in tabular form.

.2 Segregate runs by service vault location and by type of cable.

.3 Report Submission:

.1 Submit three 3 reports printed on 215 mm x 280 mm white paper. Provide one copy with cerlox binding for systems administrator. Leave remaining copies unbound for insertion into O&M manuals.

.2 Submit report prepared in electronic form using Microsoft Excel.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Basis of Payment .1 No measurement for payment will be made under this Section.
- 1.2 References .1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- 1.3 Samples .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
  - .2 Allow sampling by third-party tester during production.
  - .3 Provide third-party tester with access to source and processed material for sampling if requested by Departmental Representative.
  - .4 Install sampling facilities at discharge end of production conveyor, to allow third party tester to obtain representative samples of items being produced. Stop conveyor belt when directed by third-party tester to permit full cross section sampling.
  - .5 Do not stockpile material so as to interfere with site operation and drainage.

**PART 2 - PRODUCTS**

- 2.1 Materials - General .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
    - .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
      - .1 Greater dimension to exceed 5 times least dimension.
    - .3 Fine aggregates satisfying requirements of applicable section to be one or blend of following:
      - .1 Natural sand.
      - .2 Manufactured sand.
      - .3 Screenings produced in crushing of quarried rock, boulders, or gravel.
    - .4 Coarse aggregates satisfying requirements of applicable section to be one or blend of following:
      - .1 Crushed rock.
      - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
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- .5 All crushed gravel when tested to ASTM C136 and ASTM C117 to conform to the following:
- .2 Liquid limit: maximum 25.
  - .3 Plasticity index: maximum 6.
  - .4 Crushed particles: at least 20% of particles by mass retained on 4.75 mm sieve to have at least one freshly fractured face.

**2.2 Granular Pipe Bedding and Surround**

- .1 Crushed stone or graded gravels to conform to the following gradations:

<b>Sieve Designation</b>	<b>% Passing</b>
25 mm	100
19 mm	90 – 100
12.5 mm	65 – 85
9.5 mm	50 – 70
4.75 mm	25 – 50
2.36 mm	10 – 35
1.18 mm	6 – 26
0.600 mm	3 – 17
0.075 mm	0 – 5

**2.3 Drain Rock**

- .1 Clean round stone or crushed stone to conform to the following gradations:

<b>Sieve Designation</b>	<b>% Passing</b>
25 mm	100
19 mm	0 – 100
9.5 mm	0 – 5
4.75 mm	0

Drain rock to be used only where specified. Use of drain rock other than as specified requires approval from the Departmental Representative.

**2.4 Pit Run Gravel**

- .1 Well graded granular material free from clay lumps, organic material and other extraneous material.

<b>Sieve Designation</b>	<b>% Passing</b>
75 mm	100
50 mm	70 - 100
25 mm	50 - 100
4.75 mm	22 - 100
2.36 mm	10 - 85
0.075 mm	2 - 8

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2.5 Crushed Course Aggregate .1 Clear crushed stone to conform to the following gradations:

Sieve Designation	% Passing
50 mm	100
38 mm	75 – 100
25 mm	40 – 70
19 mm	12 - 42
12.5 mm	4 - 15
9.5 mm	0 - 9

2.6 Bulk Rock Fill .1 Free draining, well-graded 200 mm minus blast rock.

- 2.7 Source Quality Control .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 2 weeks prior to commencing production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative 2 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

### PART 3 – EXECUTION

- 3.1 Processing .1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.
- .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified.
- .3 Wash aggregates, if required to meet specifications.

3.2 Handling .1 Avoid segregation, contamination, and degradation of aggregate during handling and transporting.

- 3.3 Stockpiling .1 Stockpile aggregates in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpile sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling
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equipment.

- .4 Provide compacted sand or crushed gravel base not less than 300 mm in depth to prevent contamination of aggregate. Do not incorporate compacted base of pile into work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials.
- .7 Stockpile aggregates in uniform layers of thickness as follows:
  - .1 Max 1.5 m for coarse aggregate and base course materials.
  - .2 Max 1.5 m for fine aggregate and sub-base materials.
  - .3 Max 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

#### 3.4 Cleaning

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for grubbing to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: excavating and disposing stumps and roots to 150 mm below existing ground surface, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities.
- 1.2 Definitions
- .1 Clearing: Cutting of trees, brushing vegetative growth to ground level and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
  - .2 Grubbing: Excavating and disposing stumps and roots to 150 mm below existing ground surface.
  - .3 Chipping: Mechanically breaking down of all vegetation up to 120 mm in diameter into chips not over 100 mm long, 25 mm wide and 10 mm thick.
  - .4 License to Cut: License required by Contractor under Province of British Columbia's Forest Act that authorizes a Contractor to salvage and remove timber from Crown Land.
  - .5 Merchantable Timber: Timber greater than 120 mm diameter at breast height and suitable for salvage. This material is the property of the Contractor.
  - .6 Stumpage: Payment by Contractor to Province of British Columbia for timber harvested under License to Cut. Stumpage is required as condition of License to Cut by Province of British Columbia's Forest Act.
- 1.3 Storage and Protection
- .1 Prevent damage to trees, bench marks, existing chip seal, site appurtenances, watercourses, root systems of trees, all natural features and artificial structures that are to remain.
  - .2 Repair any damaged items to satisfaction of Departmental Representative.
  - .3 Protect nesting birds in accordance with Section 01 35 43 – Environmental Protection.
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**PART 2 - PRODUCTS**

2.1 Not Used .1 Not Used.

**PART 3 – EXECUTION**

3.1 Preparation .1 Inspect site and verify with Departmental Representative, items designated to remain.

.2 Contractor to provide License to Cut.

3.2 Clearing .1 Clear, in accordance with Contract Documents, by cutting flush with ground, except in areas where hand clearing is required. Cut hand cleared areas to within 150 mm of ground.

.2 Cut off branches and cut down trees overhanging cleared area as required for safety and in accordance with the Contract Documents.

.3 Clearing works have been undertaken by separate Contract.

3.3 Grubbing .1 Grub out stumps, roots, and embedded logs to not less than 150 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.

3.4 Removal and Disposal .1 Cut timber greater than 125 mm diameter to 3.0 m lengths and cold-deck as required by British Columbia Ministry of Forests. Stockpiled timber becomes property of Contractor.

.2 Dispose of cleared and grubbed materials off site.

3.5 Burning .1 Is not allowed.

3.6 Salvage of Timber .1 Salvage timber:

.1 Salvage timber according to License to Cut.

.2 Remove salvaged timber from site.

.3 Salvaged timber becomes property of the Contractor.

.4 Pay stumpage fees associated with salvage of timber and provide Departmental Representative with proof that stumpage has been paid.

3.7 Finished Surface .1 Leave ground surface in condition suitable for stripping of topsoil.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Measurement for Payment .1 No separate payment will be made for excavating, trenching and backfilling. These items shall be included in all work as part of total contract amount.
- 1.2 References .1 American Society for Testing and Materials (ASTM):
- .1 ASTM C 117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D 698-00a1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ) (600 kN-m/m ).
  - .5 ASTM D 1557-02e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ) (2,700 kN-m/m ).
  - .6 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA):
- .1 CAN/CSA-A3000, Portland Cement.
  - .2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- 1.3 Definitions .1 Excavation classes: two classes of excavation will be recognized: common excavation and rock excavation.
- .1 Rock: material from solid masses of igneous, sedimentary or metamorphic rock that, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass. Boulder or rock fragments measuring in volume one cubic metre or more.
  - .2 Common excavation: excavation of materials of whatever nature, that are not included under definitions of rock excavation.
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- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
  - .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
  - .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
  - .5 Unsuitable materials:
    - .1 Weak and compressible materials under excavated areas.
    - .2 Frost susceptible materials under excavated areas.
    - .3 Frost susceptible materials:
      - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.2.
      - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 – 80
0.005 mm	0 – 45
      - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
  - .6 Unshrinkable fill:
    - .1 Very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- 1.4 Quality Assurance
- .1 Engage services of qualified Professional Engineer who is registered or licensed in Province of British Columbia, Canada in which Work is to be carried out to design and inspect shoring and bracing required for Work if required by applicable legislation.
  - .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
  - .3 At least 2 weeks prior to performing Excavation, Trenching, or Backfilling Work, Contractor to provide Departmental Representative with a Construction Sequence for the Work. Do not proceed with the Work until approval has been received from the Departmental Representative.
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- 1.5 Waste Management and Disposal .1 Dispose of waste materials in accordance with Section 01 74 21 - Waste Management and Disposal and the Waste Management Workplan.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Ensure emptied containers are sealed and stored safely.
- 1.6 Protection of Existing Features .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Existing surface features:
- .1 Conduct, with Departmental Representative, condition survey of existing trees and other plants, survey bench marks and monuments which may be affected by Work.
- .2 Protect existing surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.
- .3 Where required for excavation, cut roots or branches as approved by Departmental Representative.

## PART 2 - PRODUCTS

- 2.1 Materials .1 Granular bedding to Section 31 05 16 – Aggregates.
- .2 Trench backfill to Section 32 11 16 – Granular Sub-base

## PART 3 - EXECUTION

- 3.1 Site Preparation .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- 3.2 Stripping of Topsoil .1 Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds, and grasses.
- .2 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2m.
- .4 Dispose of unused topsoil as directed by Departmental Representative.
- 3.3 Stockpiling .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
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- 3.4 Cofferdams, Shoring, Bracing and Underpinning .1 Construct temporary Works to depths, heights, and at locations as required to protect existing structures, embankment slopes, roadway embankment fill, etc. If required, temporary works to be designed and stamped by a Professional Engineer registered in the Province of British Columbia.
- .2 During backfill operation:
- .1 Unless otherwise as indicated or as directed by Departmental Representative, remove sheeting and shoring from excavations.
- .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500mm above toe of sheeting.
- .3 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- 3.5 Dewatering and Heave Prevention .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs, if required.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Protection and in manner not detrimental to public and private property or any portion of Work completed or under construction.
- .6 Provide silt fences, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to water courses or drainage areas.
- 3.6 Excavation .1 Excavate to lines, grades, elevations and dimensions as indicated on the drawings or as required.
- .2 Perform wingwall / excavation work symmetrically about the centreline of bridge both longitudinally and transversely. i.e. soil pressure loads to be balanced on both abutments during the course of the work.
- .3 Excavate only the required soil underneath of the bridge to complete the work at hand (i.e. perform the excavation work in stages). Install the top parts of the wingwalls first and work downwards below ground. This will help eliminate the potential for embankment fill sloughing. Also, as work proceeds downwards, install the wall components
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between the concrete abutment columns first before outside of the concrete columns.

- .4 Excavation work to be as minimal as possible.
- .5 Excavation must not interfere with capacities of adjacent foundations and roadway fills. It is the Contractor's responsibility to determine if any temporary works are required to maintain stabilities during construction.
- .6 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .7 Dispose of surplus and unsuitable excavated material in approved location off site.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Notify Departmental Representative when bottom of excavation is reached.
- .11 Obtain Departmental Representative approval of completed excavation.
- .12 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with fill concrete.
  - .2 Fill under other areas with granular sub-base fill compacted to not less than 95% of corrected maximum dry density.
- .13 Hand trim, make firm, and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### 3.7 Backfilling

- .1 Do not proceed with backfilling operations until Departmental Representative has approved.
  - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
  - .3 Do not use backfill material that is frozen or contains ice, snow or debris.
  - .4 Place backfill material in uniform layers not exceeding 150mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
  - .5 Backfilling around installations:
    - .1 Place bedding and surround material as specified elsewhere.
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- .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously at both ends of the bridge to equalize loadings on the structure as a whole. Difference not to exceed 0.3m from one abutment to the other.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
    - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
  - .6 Install drainage system in backfill if indicated by Departmental Representative.
  - .7 Care must be taken next to existing structures and next to new structures when performing backfilling operations.
- 3.8 Restoration
- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Measurement for Payment .1 Payment for clearing and grubbing will be made under payment items in Section 31 11 00 - Clearing and Grubbing.
- .2 Payment for geosynthetic material will be made under payment items in Section 31 32 19 – Geotextiles.
- .3 Payment for excavation:
- .1 Shall be full compensation for all work necessary and incidental for excavation and disposal of surplus, unsuitable and waste materials including stripping; site drainage and all other related surface works within limits of the Work, or otherwise indicated, to the required subgrade elevations for the construction of road works and related facilities.
- .2 Measurement for payment for this item shall be at the unit price for each cubic meter of excavation as measured and accepted by the Departmental Representative.
- .5 Payment for embankment fill:
- .1 Shall be full compensation for all work necessary and incidental for placing granular fill material from approved subgrade to the underside of granular sub-base within the proposed road right-of-way, or otherwise indicated, for the construction of roadworks and other related surface works as indicated in the Contract Documents.
- .2 Subgrade elevation shall be determined by the lines, grades, and cross-sections for finished road surface elevations as indicated, less the minimum thicknesses for asphalt pavement, granular base and granular sub-base materials in accordance with the Contract Document and as directed by the Departmental Representative.
- .3 Payment for Contractor supplied embankment fill shall include, but not limited to: supplying, hauling, placing and compacting of granular material to finished subgrade elevation for construction of all surface works, and protection of the placed material to reasonably prevent such events that may affect the performance of the subgrade
- .4 Measurement for payment for embankment fill shall be at the unit price for each cubic metre of compacted granular sub-base placed to the specified thickness and density as measured and accepted by the Departmental Representative.
- .6 Payment for over-excavation and fill:
- .1 Shall be full compensation for all work necessary and incidental, over and above the cost of common excavation
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included elsewhere; for over-excavation of the subgrade including loading, hauling and off-site disposal of material; and supply, hauling, placing and compaction of embankment fill to the design subgrade in accordance with the Contract Documents and as directed by the Departmental Representative.

- .2 The Contractor shall expose the subgrade and notify the Departmental Representative in a timely manner in order that the Contractor's survey and layout be verified by the Departmental Representative prior to placing granular fill. Any materials removed prior to taking profile measurements will not be included in the computation of quantities for payment
- .3 Measurement for payment of this item will be at the unit price for each cubic metre based on 'in-place' measurements using average end area method as determined, measured and accepted by the Departmental Representative.

**1.2 References**

- .1 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft) (600 kN-m/m).

**1.3 Definitions**

- .1 Rock Excavation: excavation of:
    - .1 Material from solid masses of igneous, sedimentary or metamorphic rock that, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass.
    - .2 Boulder or rock fragments measuring in volume one cubic metre or more.
  - .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping Excavation.
  - .3 Stripping Excavation: excavation of organic material covering original ground.
  - .4 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
  - .5 Waste material: material other than Stripping Excavation that is unsuitable for embankment construction or material surplus to requirements.
  - .7 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
  - .8 Road Reclamation: excavation of existing road bed materials deemed acceptable for use as Embankment.
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- 1.5 Requirements of Regulatory Agencies .1 Adhere to Provincial and Federal Environmental requirements if potentially toxic materials are involved.
- 1.6 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

## PART 2 – PRODUCTS

- 2.1 Materials .1 Granular materials in accordance with Section 31 05 16 – Aggregates.  
.2 Geosynthetic material in accordance with Section 31 32 19 – Geotextiles
- 2.2 Specified Materials .1 Embankment materials require approval by the Departmental Representative.  
.2 Embankment may be:  
.1 Approved native or imported granular material not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps, or any other unsuitable material.  
.2 Pit run gravel  
.3 Road reclamation meeting the pit run gravel specification  
.4 Bulk rock fill  
.5 Course crushed aggregate

## PART 3 - EXECUTION

- 3.1 General .1 Clear and grub to the limits of excavation and/or embankment fill in accordance with Section 31 11 00 Clearing and Grubbing.  
.2 Provide suitable temporary ditches or other suitable means of handling drainage prior to excavation and during construction to protect the construction area  
.3 Comply with Section 01 35 43 Environmental Procedures.
- 3.2 Stripping .1 Commence topsoil stripping of areas as indicated after brush, weeds and grasses have been removed from these areas.  
.2 Strip to depths as indicated or as necessary to remove all organic material.  
.3 Do not mix topsoil with subsoil.  
.4 Stockpile in locations in accordance with Contract Documents or as directed by Departmental Representative.  
.5 Dispose of unused stripped topsoil in accordance with Contract
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- Documents or as directed by Departmental Representative.
- .6 Prevent clearing and grubbing debris from mixing with stripped topsoil.
  - .7 Upon completion of excavation and embankment construction spread stripped topsoil on slopes and trim, as directed by the Departmental Representative.
- 3.3 Excavating
- .1 General:
    - .1 Notify Departmental Representative when unsuitable materials are encountered. Remove to depth and extent directed by Departmental Representative.
    - .2 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points in accordance with typical drawing, or as directed by Departmental Representative.
  - .2 Maintain profiles, crowns and cross slopes to provide good surface drainage.
  - .3 Road reclamation:
    - .1 If the Contractor wishes to use the existing road base material as embankment fill, notify the Departmental Representative. Contractor to confirm material meets the gradations of Pit Run Gravel. Material may be used at the discretion of the Departmental Representative.
  - .3 Rock Excavation:
    - .1 If, during excavation, material appearing to conform to classification for rock is encountered, notify Departmental Representative and provide sufficient time to take measurements to determine volume of rock.
    - .2 Shatter rock to 300mm below subgrade elevation or as indicated on plans, if required.
- 34 Inspection of Subgrade
- .1 Prior to placing any fill materials, proof roll graded native surface using a fully loaded single or dual axle dump truck in the presence of the Departmental Representative.
  - .2 Departmental Representative may authorize the use of other acceptable proof rolling equipment.
  - .3 Remove soft or other unsuitable material.
  - .4 Replace and compact with approved embankment fill. At the direction of the Departmental Representative, the Contractor to replace with course crushed aggregate and geotextiles.
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- 3.5 Placing
- .1 Place material only on clean unfrozen surfaces, properly shaped and compacted, free from snow and ice.
  - .2 Maintain crowned surface during construction to ensure ready run-off of surface water.
  - .3 Drain low areas before placing materials.
  - .4 Place materials using methods which do not lead to segregation or degradation to the full width in uniform layers and compacted to specified densities.
  - .5 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
  - .6 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved. Bulk rock fill in layers not exceeding 300 mm and compacted by a minimum of four passes of a 10 tonne vibratory roller or as directed by the Departmental Representative.
  - .7 Where material consists of rock:
    - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1m.
    - .2 Carefully distribute rock material to fill voids with smaller fragments to form compact mass.
    - .3 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
    - .4 Do not place boulders and rock fragments with dimensions exceeding 150mm within 300mm of subgrade elevation.
  - .8 Embankments to be sloped to Departmental Representative's requirements. Intent is that slopes be as gentle as possible within limitations of site geometry.
- 3.6 Compaction
- .1 Compaction equipment must be capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.
  - .2 Break material down to sizes that enable required compaction and mix for uniform moisture to full depth of layer.
  - .2 Compact each layer to minimum 95% maximum dry density, to ASTM D698 and ASTM D4718 except top 150mm of subgrade. Compact top 150 mm to 100% maximum dry density.
  - .3 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction. If material is
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excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction or remove material.

- 3.7 Finishing
- .1 Shape entire roadbed to within 25mm of design elevations and to Departmental Representative's satisfaction.
  - .2 Finish slopes and ditch bottoms to neat condition, true to lines, grades and drawings where applicable.
  - .3 Remove rocks over 150mm in any dimension from slopes and ditch bottoms.
  - .4 Hand finish slopes that cannot be finished satisfactorily by machine.
  - .5 Round top of backslope 1.5 m on both sides of top of slope.
  - .6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags, ruts, and protruding stones.
- 3.8 Protection
- .1 Maintain finished surfaces in condition conforming to this Section until placement of subsequent materials.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Materials and installation of polymeric geotextiles used in revetments, retaining wall structures, filtration, drainage structures road and trail beds and serves the purpose to:
- .1 Separate and prevent mixing of granular materials with the existing native subgrade.
  - .2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.
  - .3 Provide additional strength to sub-grade.
- 1.2 Measurement for Payment .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supplying and placing geotextiles to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: supply and installation of geotextiles and retaining pins, if required, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each square meter of geotextile installed as measured and accepted by the Departmental Representative. Overlap, as specified herein, to be considered incidental in the payment item.
- 1.3 References .1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2 ASTM D4595-86(2001), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .3 ASTM D4716-01, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .4 ASTM D4751-99a, 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, 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
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- 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/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
    - .2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - 1.4 Submittals
    - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
    - .2 Submit to Departmental Representative (if requested) following samples at least 4 weeks prior to beginning Work.
      - .1 Minimum length of 2 m of roll width of geotextile.
      - .2 Minimum of 1 m seam with at least 300 mm of geotextile on both sides of seam.
    - .3 Submit to Departmental Representative 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.
  - 1.5 Delivery and Storage
    - .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.
  - 1.6 Waste Management and Disposal
    - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
    - .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
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**PART 2 - PRODUCTS**

- 2.1 Material
- .1 Non-woven Geotextile:
    - .1 Composed of 100% polypropylene, non-woven, synthetic fibre fabric.
    - .2 Suppled in rolls, minimum 4.75 metres in width.
    - .3 Grab Tensile Strength > 700 N (ASTM-D4632)
    - .4 CBR Puncture > 1800 N (ASTM-D6241)
    - .5 Based on general physical properties outlined above, equivalent geotextiles would be Nilex 4551.
  - .2 Biaxial Geogrid:
    - .1 Composed of: 100% by polypropylene, open grid, biaxial orientation, free of striations, roughness, pinholes, blisters, undispersed raw materials or any sign of contamination by foreign matter.
    - .2 Suppled in rolls, minimum 4.75 metres in width.
    - .3 Tensile Strength at 2% Strain: 6.0 kN/m (MARV)
    - .4 Flexural Stiffness: 750,000 mg-cm
    - .5 Based on general physical properties outlined above, equivalent biaxial geogrids would be Tensar Biaxial Geogrid, Type 2
  - .3 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.
- 2.2 Material Supplied By Owner
- .1 The Owner has 123 rolls (17ft x 265ft per roll) of Mirafi HP570 geotextile that can be used in lieu of the non-woven geotextile.
  - .2 Geotextile rolls are located at the sewage lagoon within the Park. Access road to the sewage lagoon is north of the Wick Road access off Highway 4.
  - .3 Material usage will be quantified and monitored by the Departmental Representative.

**PART 3 - EXECUTION**

- 3.1 Installation
- .1 Prepare subgrade by grading to provide a smooth, uniform surface. Remove all stumps, large rock, brush or other debris that could damage the fabric. Fill all holes and depressions so that the fabric does not
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bridge them. Replace loose or unstable soils.

- .2 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated. Retain in position with retaining pins if required.
- .3 Place geotextile material smooth in a loose fashion and free of tension stress, folds, wrinkles and creases.
- .4 Place geotextile material on surfaces in one continuous length.
- .5 Overlap each successive strip of geotextile over previously laid strip. Fabric lap in accordance with manufacturer's recommendations and minimum 1000mm lap for woven and 300mm lap for non-woven.
- .6 Take care to prevent puncturing or tearing the geotextile. Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers. Repair all damage by use of patches that extend at least 1.0 m beyond the perimeter of the tear or puncture.
- .7 After installation, cover with overlying granular layer within sufficient time so that ultraviolet damage does not occur. In no case shall this time exceed 7 days for ultraviolet susceptible material and 14 days for ultraviolet protected and low ultraviolet susceptible polymer geotextiles.
- .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .9 For geotextiles under rip-rap commence rip-rap placement at the base of the blanket area and proceed up the slope. Limit the height of drop of rip-rap to 1.0m or less. Do not allow the rip-rap to roll down the slope.

### 3.2 Protection

- .1 No vehicles permitted directly on geotextile.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling and placing of riprap to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: supply and placement, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each square meter of riprap placed to the specified thickness, based on the riprap class as measured and accepted by the Departmental Representative.

**PART 2 – PRODUCTS**

- 2.1 Stone .1 Hard, dense, durable quarry stone, angular in shape, resistant to weathering and water action, free from overburden, spoil, shale or shale seams, and organic material, Care shall be taken to avoid introducing evasive plants into the park by using clean materials. All stones having maximum dimension not greater than three times its least dimension, to meet following size distribution:

Class of Riprap (kg)	Nominal Thickness of Riprap (mm)	Rock Gradation: Percentage Larger Than Given Rock Mass		
		85%	50%	15%
10	350	1 kg	10 kg	30 kg
25	450	2.5 kg	25 kg	75 kg
50	550	5 kg	50 kg	150 kg

- .2 The minimum acceptable unit weight of the rock is 2.5 tonnes/cubic metre.
- 2.2 Geotextile Filter .1 Geotextile: in accordance with Section 31 32 19 – Geotextile.
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**PART 3 - EXECUTION**

- 3.1 Processing .1 Process riprap uniformly using methods that prevent contamination, segregation, and degradation.
- 3.2 Handling .1 Handle and transport riprap to avoid segregation, contamination, and degradation.
- 3.4 Placing .1 Where riprap is to be placed on slopes, excavate trench at toe of slope first, if and where instructed by the Departmental Representative.
- .2 Where riprap is to be placed, fine grade the area first to provide a uniform and even surface, if and where instructed by the Departmental Representative. Fill any depressions with suitable materials and compact to provide a firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19 – Geotextiles and as indicated. Avoid puncturing geotextile. Vehicle Traffic over geotextile is not permitted.
- .4 Place rip-rap to thickness and detailed as indicated on the drawing.
- .5 Place stones to secure the surface of the slope and create a stable mass. Place larger stones at the bottom of the slopes.
- .6 Use larger stones for lower courses and as headers for subsequent courses.
- .7 Stagger vertical joints and fill voids with rock spalls or cobbles.
- .8 Finished surface to be reasonably uniform and even, free from bumps, depressions, underlying voids, large openings, or individual stones projecting out above apparent surface.
- .9 Place riprap prior to permitting water to pass through slope drains, as applicable.
- .8 Be careful not the damage the structure (new and existing components) in any way during riprap movement. Any damages shall be repaired at the expense of the Contractor.
- .10 Place layers simultaneously at both ends of the bridge to equalize loadings on the structure as a whole. Difference not to exceed 0.3m from one abutment to the other.
- .11 Embankments to be sloped to Departmental Representative's requirements. Intent is that slopes be as gentle as possible within limitations of site geometry. Intent is that slopes to be reinforced with riprap to prevent future roadway embankment and river slope erosion, scour, migration, etc.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling, placing, rolling and compaction of 300mm thickness of granular sub-base to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: supply and application of water as required to meet specified density, compaction testing to confirm compliance with specifications, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the unit price for each square meter of compacted granular sub-base placed to the specified thickness and density as measured and accepted by the Departmental Representative.
- 1.2 References
- .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .4 ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
  - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
  - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - .7 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .8 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
-

**PART 2 - PRODUCTS**

2.1 Materials .1 Granular Sub-base: material to Section 31 05 16 – Aggregates following requirements:

- .1 Crushed stone or gravel.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.1 Gradation to:

<b>Sieve Designation</b>	<b>% Passing</b>
75 mm	100
38 mm	60 – 100
19 mm	35 – 80
9.5 mm	26 – 60
4.75 mm	20 – 40
2.36 mm	15 – 30
1.18 mm	10 – 20
0.600 mm	5 – 15
0.300 mm	3 – 10
0.075 mm	0 – 5

- .2 Liquid limit: to ASTM D4318, maximum 25.
- .3 Plasticity index: to ASTM D4318, maximum 6.
- .4 Crushed particles: 60% of the material passing each sieve must have one or more fractured faces.

2.2 Materials Supplied By  
Owner

- .1 The Owner has a stockpile of granular material conforming to the gradations specified above.
  - .2 Available stockpiled material is approximately 6,400 (loose) cubic metres
  - .3 Material is located at Dolan's Concrete pit. Access road to the pit is south of the Highway 4 / Tofino Ucluelet Highway junction.
  - .4 Material will be loaded and weighed on the pit Owner's scale. Scale information slips to be presented to Departmental Representative on a daily basis.
  - .5 Material usage will be quantified and monitored by the Departmental Representative.
-

**PART 3 – EXECUTION**

- 3.1 Sequence of Operation
- .1 Stockpile Granular Sub Base off site as specified under Section 31 05 16 – Aggregates.
  - .2 Place Granular Sub-base after subgrade is inspected and accepted by Departmental Representative.
  - .3 Placing:
    - .1 Construct Granular Sub-base to depth and grade in areas indicated.
    - .2 Ensure no frozen material is placed.
    - .3 Place material only on clean unfrozen surface, properly shaped and compacted, and free from snow and ice.
    - .4 Begin spreading sub-base material on crown line or on high side of one-way slope.
    - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
    - .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
    - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
    - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
  - .4 Compaction Equipment:
    - .1 Compaction equipment to be capable of obtaining required material densities.
  - .5 Compacting:
    - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698-00a and D4718.
    - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
    - .3 Apply water as necessary during compacting to obtain specified density.
    - .4 Dry gravel if granular sub-base is excessively moist.
    - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
    - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
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- 3.2 Site Tolerances .1 Finished sub-base surface to be within plus or minus 15 mm of established grade and cross section and specified thickness.
- 3.3 Maintenance .1 Maintain finished Granular Sub-base in condition conforming to this Section until acceptance by Departmental Representative and until succeeding material is applied.
- .2 Apply dust control measures as required.
- .3 Ensure that Granular Sub-base surface is in properly compacted state prior to application of succeeding material.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling, placing, rolling and compaction of crushed gravel granular base to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: supply and application of water as required to meet specified density, compaction testing to confirm compliance with specifications, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for granular base shall be at the unit price for each square meter of compacted granular sub-base placed to the specified thickness and density as measured and accepted by the Departmental Representative.
  - .4 Measurement for payment for shouldering gravel shall be at the unit price for each square meter of compacted granular sub-base material placed to the specified thickness and density as measured and accepted by the Departmental Representative.
- 1.2 References
- .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .5 ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
  - .6 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
  - .7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - .9 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .10 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
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**PART 2 - PRODUCTS**

- 2.1 Materials .1 Granular base: material to Section 31 05 16 - Aggregates and following requirements:
- .1 Crushed stone or gravel. Material shall be completely free of evasive species of vegetation through using clean crushed rock or washed materials.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

- .1 Gradation to:

<b>Sieve Designation</b>	<b>% Passing</b>
25 mm	100
19 mm	80 - 100
9.5 mm	50 - 85
4.75 mm	35 - 70
2.36 mm	25 - 50
1.18mm	15 - 35
0.300 mm	5 - 20
0.180 mm	-
0.075 mm	1 - 5

- .2 Liquid limit: ASTM D4318, max. 25.
- .3 Plasticity index: ASTM D4318, max. 6.
- .4 Crushed Particles: 60% of the material passing each sieve must have one or more fractured faces.

**PART 3 – EXECUTION**

- 3.1 Sequence of Operation .1 Stockpile Granular Base off site as specified under Section 31 05 16 – Aggregates.
- .2 Place Granular Base after underlying surface is to within tolerances.
- .3 Placing:
- .1 Construct Granular Base to depth and grade in areas indicated.
- .2 Ensure no frozen material is placed.
- .3 Place on clean unfrozen surface, properly shaped and compacted, free from snow and ice.
- .4 Begin spreading base material on crown line or on high side of one-way slope.
- .5 Place material using methods which do not lead to segregation or degradation of aggregate.
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- .6 Place material to full width in uniform layers not exceeding 100 mm compacted thickness.
- .7 Shape layer to smooth contour and compact to specified density before proceeding to paving.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .9 Place shouldering gravels upon completion of paving to the dimensions shown on the contract drawings. Compact material as described in 3.1.5 of this specification. Sweep asphalt surface upon completion of placing shoulder gravel.
- .4 Compaction Equipment:
  - .1 Compaction equipment to be capable of obtaining required material densities.
- .5 Compacting:
  - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698 and D4718.
  - .2 Shape and roll alternately to obtain smooth, even, and uniformly compacted base.
  - .3 Apply water as necessary for compacting to obtain specified density.
  - .4 Dry gravel if Granular Base is excessively moist.
  - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
  - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- 3.2 Site Tolerances
  - .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section or as directed by Departmental Representative.
- 3.3 Maintenance
  - .1 Maintain finished Base in condition conforming to this Section until acceptance by Departmental Representative and until succeeding material is applied.
  - .2 Apply dust control measures as required.
  - .3 Ensure that Granular Base surface is in properly compacted state prior to application of succeeding material.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement Procedures .1 No separate payment will be made for asphalt prime coat. Payment for asphalt prime coat is considered as incidental to the work and to be included in the relevant unit prices in this contract.
- 1.2 References .1 American Association of State Highway and Transportation Officials (AASHTO)
- .1 AASHTO M081-92-UL-04, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
- .2 ASTM International
- .1 ASTM D140/D140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 ASTM D633-11, Standard Volume Correction Table for Road Tar.
- .3 ASTM D1250-08, Standard Guide for Use of the Petroleum Measurement Tables.
- .3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.3 Action and Informational Submittals .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt tack coat and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
- .1 Submit two - 4 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth containers to Departmental Representative, at least 2 weeks prior to beginning Work.
- .2 Sample asphalt tack coat material to: ASTM D140.
- .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work to ASTM D140.
- 1.4 Quality Assurance .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.
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- 1.5 Delivery, Storage and Handling
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements with manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Storage and Handling Requirements:
    - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Replace defective or damaged materials with new.
  - .4 Deliver, store and handle materials in accordance with ASTM D140.
  - .5 Provide, maintain and restore asphalt storage area.
- 1.6 Waste Management and Disposal
- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

## PART 2 - PRODUCTS

- 2.1 Materials
- .1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.
  - .2 Water: clean, potable, free from foreign matter.
- 2.2 Equipment
- .1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.
  - .2 Pressure distributor:
    - .1 Designed, equipped, maintained and operated so that asphalt material can be:
      - .1 Maintained at even temperature.
      - .2 Applied uniformly on variable widths of surface up to 5 m.
      - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m<sup>2</sup>.
      - .4 Distribute in uniform spray without atomization at temperature required.
    - .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
    - .3 Equipped with pump having flow meter graduated in units of
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- 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
- .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
    - .1 Measure temperature to closest whole number.
  - .5 Equipped with accurate volume measuring device or calibrated tank.
  - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
  - .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
  - .8 Cleaned if previously used with incompatible asphalt material.

### PART 3 - EXECUTION

- 3.1 Examination
    - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt tack coat installation in accordance with manufacturer's written instructions.
      - .1 Visually inspect substrate in presence of Departmental Representative.
      - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
      - .3 Proceed with installation only after unacceptable conditions have been remedied.
  - 3.2 Application
    - .1 Apply asphalt tack coat only on clean and dry surface.
    - .2 Dilute asphalt emulsion with water at 1:1 ratio for application.
      - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
    - .3 Apply asphalt tack coat evenly to pavement surface at rate as required but not to exceed 0.7 L/m<sup>2</sup> when diluted with water at 1:1 ration.
    - .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
    - .5 Apply asphalt tack coat only when air temperature greater than 5 degrees C and when rain is not forecast within 2 hours minimum of application.
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- .6 Apply asphalt tack coat only on unfrozen surface.
  - .7 Apply tack coat only to surfaces that are expected to be overlaid on same day.
  - .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
  - .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
  - .10 Keep traffic off tacked areas until asphalt tack coat has set.
  - .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
  - .12 Permit asphalt tack coat to cure before placing asphalt pavement.
  - .13 Carry out measurements in presence of Departmental Representative upon request.
  - .14 Inspect tack coat application to ensure uniformity.
    - .1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Departmental Representative.
    - .2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.
- 3.3 Cleaning
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement Procedures .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply and placing of asphalt prime coat to the lines, grades and cross-sections indicated for designated asphaltic pavement areas as indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: priming of prepared surfaces; and all other work and materials incidental and necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each neat square metre of asphalt prime coat placed, measured and accepted by the Departmental Representative.
- 1.2 References .1 ASTM International
- .1 ASTM D140/D140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.
- .2 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.3 Action and Informational Submittals .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt prime coat and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
- .1 Submit two 4 L samples of asphalt prime proposed for use in new, clean, air tight sealed, wide mouth containers, to Departmental Representative, 2 weeks prior to commencing Work.
- .2 Sample asphalt prime coat materials in accordance with ASTM D140.
- .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.
- 1.4 Quality Assurance .1 Upon request from Departmental Representative, submit manufacturer's
-



test data and certification that asphalt prime material meets requirements of this Section.

- 1.5 Delivery, Storage and Handling
- .1 Deliver materials in accordance with Section 01 61 00 - Product Requirements with manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .1 Arrange points of delivery and quantity to be shipped with vendor.
    - .2 Make deliveries during normal work hours.
    - .3 Include copy of orders and instructions respecting shipment upon request by Departmental Representative.
    - .4 Include suitable unloading facilities and unload asphalt as directed Departmental Representative.
    - .5 Provide, maintain and restore asphalt storage area.
  - .3 Storage and Handling Requirements:
    - .1 Deliver, store and handle materials to ASTM D140.
    - .2 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .3 Replace defective or damaged materials with new.

## PART 2 - PRODUCTS

- 2.1 Material
- .1 Asphalt material: to CAN/CGSB-16.1 grade RM-20, MC-70 or CAN/CGSB-16.2 grade SS-1h.
  - .2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
  - .3 Water: clean, potable, free from foreign matter.
- 2.2 Equipment
- .1 Pressure distributor:
    - .1 Designed, equipped, maintained and operated so that asphalt material can be:
      - .1 Maintained at even temperature.
      - .2 Applied uniformly on variable widths of surface up to 5 m.
      - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with allowable variation from any specified rate not
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- exceeding 0.1 L/m<sup>2</sup>.
- .4 Distribute in uniform spray without atomization at temperature required.
- .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
- .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
- .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
  - .1 Measure temperature to closest whole number.
- .5 Equipped with accurate volume measuring device or calibrated tank.
- .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
- .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
- .8 Cleaned if previously used with incompatible asphalt material.
- .2 Aggregate Spreader:
  - .1 Apply blotter sand to primed surfaces using roll type spreader, or rotating disc sander capable of applying aggregate at variable widths and at variable rates.

### PART 3 - EXECUTION

- 3.1 Examination
    - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt prime coat installation in accordance with manufacturer's written instructions.
      - .1 Visually inspect substrate in presence of Departmental Representative.
      - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
      - .3 Proceed with installation only after unacceptable conditions have been remedied.
  - 3.2 Application
    - .1 Proceed with application of prime coat only after receipt of approval of
-

- granular base surface from Departmental Representative.
  - .2 Cutback asphalt:
    - .1 Heat MC70 asphalt prime to between 60 and 70 degrees C for pumping and spraying in accordance with manufacturer's instructions.
    - .2 Apply asphalt prime to granular base at rate as required but not to exceed 2 L/m<sup>2</sup>.
    - .3 Apply on damp surface unless otherwise directed by Departmental Representative.
  - .3 Emulsified asphalt:
    - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.
    - .2 Mix thoroughly by pumping or other method approved by Departmental Representative.
    - .3 Apply diluted asphalt emulsion at rate as required but do not exceed 5 L/m<sup>2</sup>.
    - .4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.
  - .4 Apply asphalt prime only on unfrozen surface.
  - .5 Apply asphalt prime coat only when air temperature is greater than 5 degrees C and when rain is not forecast within 2 hours minimum of application.
  - .6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.
  - .7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
  - .8 Prevent overlap at junction of applications.
  - .9 Do not prime surfaces that will be visible when paving is complete.
  - .10 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.
  - .11 Keep traffic off primed areas until asphalt prime has cured.
  - .12 Permit prime to cure before placing asphalt paving.
  - 3.3 Use of Sand Blotter
    - .1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.
    - .2 Allow sufficient time for excess prime to be absorbed.
    - .3 Apply second application of sand blotter as required.
    - .4 Do not roll blotter sand.
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- .5 Sweep and remove excess blotter material.
- 3.4 Cleaning
  - .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**PART 1 - GENERAL****1.1 Measurement and  
Payment**

- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling, placing, rolling and compaction of hot mix asphaltic concrete pavement to the lines, grades and cross-sections indicated for designated areas as indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: provision of mix designs; tack coating of prepared surfaces as required; joint preparation; adjusting and cleaning of castings; supply, placing, rolling and compaction of the specified compacted thickness hot mix asphaltic concrete; testing; temporary pavement markings; and all other work and materials incidental and necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each neat square metre of compacted asphaltic concrete of type indicated, placed to the specified thickness as measured and accepted by the Departmental Representative.

**1.2 References**

- .1 Asphalt Institute (AI)
    - .1 AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
  - .2 ASTM International
    - .1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
    - .2 ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
    - .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
    - .4 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
    - .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
    - .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
    - .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
    - .8 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
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- .9 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
  - .10 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
  - .11 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
  - .12 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- 1.3 Action and Informational Submittals
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Product Data: Upon request of Departmental Representative, submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3 Mix Design: Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning Work.
- 1.4 Delivery, Storage and Handling
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.

**PART 2 - PRODUCTS**

- 2.1 Material
- .1 Performance graded asphalt cement: to CGSB-16.3-M90, Grade 80-100.
  - .2 RAP:
    - .1 Crushed and screened to ensure 100% of RAP material passes 37.5 mm screen before mixing.
  - .3 Aggregates: in accordance with Section 31 05 16 - Aggregate and requirements as follows:
    - .1 Crushed stone or gravel.
    - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117.
-

.3 Table:

Sieve Designation	% Passing
19 mm	100
12.5 mm	84 – 99
9.5 mm	73 – 88
4.75 mm	55 – 68
2.36 mm	35 – 55
1.18 mm	27 – 46
0.600 mm	18 – 36
0.300 mm	10 – 26
0.150 mm	4 – 17
0.075 mm	3 – 8

.4 Coarse aggregate: aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.

.5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.6 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.7 Sand equivalent: ASTM D2419. Min: 40.

.8 Magnesium Sulphate soundness: to ASTM C88. Max% loss by mass:

.1 Coarse aggregate: 15%.

.2 Fine aggregate: 18%.

.9 Los Angeles degradation: Grading B, to ASTM C131. Max% loss by mass:

.1 Coarse aggregate, surface course: 25%.

.10 Absorption: to ASTM C127. Max% by mass:

.1 Coarse aggregate, surface course: 1.75%.

.11 Loss by washing: to ASTM C117. Max% passing 0.075 mm sieve:

.1 Coarse aggregate, surface course: 1.5%.

.12 Lightweight particles: to ASTM C123. Max% by mass less than 1.95 relative density:

.1 Surface course: 1.5%.

.13 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max% by mass:

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.1 Coarse aggregate, surface course: 10%.

- .14 Crushed fragments: at least 60% of particles by mass within each of following sieve designation ranges, to have at least 2 freshly fractured faces. Material to be divided into ranges, using methods of ASTM C136.

Passing		Retained on
25 mm	to	12.5 mm
12.5 mm	to	4.75mm

- .15 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.4 Mineral filler:

- .1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by Departmental Representative are thoroughly dry and free from lumps.
- .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.
- .3 Ensure mineral filler is dry and free flowing when added to aggregate.

## 2.2 Equipment

- .1 Pavers: mechanical [grade controlled] self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
- .1 Drum diameter: 1200 mm minimum.
- .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
- .1 Boxes with tight metal bottoms.
- .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
-



.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm<sup>2</sup> for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

### 2.3 Mix Design

.1 Mix design to be approved in writing by Departmental Representative.

.2 Mix may contain maximum 20% by mass of RAP. Departmental Representative may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 75.

.2 Mix physical requirements:

Property		Roads
Marshall Stability at 60°C	kN min	5.5
Flow Value	mm	2 - 4
Air Voids in Mixture	%	3 - 5
Voids in Mineral Aggregate	% min	15
Index of Retained Stability	% min	75

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to ASTM D1559.

.2 Air voids: to ASTM D3203.

.3 Index of Retained Stability: measure in accordance with Marshall Immersion Test ASTM D1559.

.4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided and approved by Departmental Representative.

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**PART 3 - EXECUTION****3.1 Plant and Mixing  
Requirements**

- .1 Batch and continuous mixing plants:
  - .1 To ASTM D995.
  - .2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
    - .1 Do not load frozen materials into bins.
  - .3 Feed cold aggregates to plant in proportions to ensure continuous operations.
  - .4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
  - .5 Before mixing, dry aggregates to moisture content not greater than 0.5% by mass or to lesser moisture content if required to meet mix design requirements.
  - .6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
  - .7 Store hot screened aggregates in manner to minimize segregation and temperature loss.
  - .8 Maintain temperature of materials within 5° C of specified mix temperature during mixing.
  - .9 Mixing time:
    - .1 In batch plants, dry mix for hot less than 10s. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.
    - .2 In continuous mixing plants, mixing time as required but not less than 45s.
  - .10 Where RAP is to be incorporated into mix:
    - .1 Feed from separate cold feed bin specially designed to minimize consolidation of material.
      - .1 Provide 37.5 mm scalping screen on cold feed to remove oversized pieces of RAP.
    - .2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti rollback device to prevent material from sliding backward on feed belt.
    - .3 Combine RAP and new aggregates in proportions as specified. Dry mix thoroughly, until uniform temperature within plus or minus 5° C of mix

temperature is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dried mix material is above 160° C.

- .2 Dryer drum mixing plant:
  - .1 To ASTM D995.
  - .2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.
  - .3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
  - .4 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180° C.
  - .5 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.
  - .6 Meter total flow of aggregate and RAP using electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump to ensure proportions of aggregate, RAP and asphalt entering mixer remain constant.
  - .7 Allow for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.
  - .8 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
    - .1 Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time.
    - .2 Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.
  - .9 Make provision for conveniently sampling full flow of materials from cold feed.
  - .10 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.
  - .11 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

- .12 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream.
  - .1 Control heating to prevent fracture of aggregate or excessive oxidation of asphalt.
  - .2 Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator.
- .13 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is 0.5% maximum.

.3 Temporary storage of hot mix:

- .1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.
- .2 Do not store asphalt mix in storage bins in excess of 12 hour.

.4 Mixing tolerances:

- .1 Permissible variation in aggregate gradation from job mix (percent of total mass).

4.75 mm sieve and larger	5.5
2.36 mm sieve	4.5
0.600 mm sieve	3.5
0.150 mm sieve	2.5
0.075 mm sieve	1.5

- .2 Permissible variation of asphalt cement from job mix: 0.25%.
- .3 Permissible variation of mix temperature at discharge from plant: 5° C.

3.2 Preparation

- .1 Reshape granular roadbed.
- .2 When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .3 Apply prime coat and/or tack coat in accordance with Section prior to paving.
- .4 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 Transportation of Mix

- .1 Transport mix to job site in vehicles cleaned of foreign material.
-

- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.
    - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
  - .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
  - .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
    - .1 Do not dribble mix into trucks.
  - .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
  - .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within specified range, but not less than 125° C.
- 3.4 Placing
- .1 Obtain Departmental Representative's approval of base, existing surface, tack coat, or prime coat prior to placing asphalt.
  - .2 Place asphalt concrete to thicknesses, grades and lines as indicated.
  - .3 Placing conditions:
    - .1 Place asphalt mixtures only when air temperature is 5° C minimum.
    - .2 When temperature of surface on which material is to be placed falls below 10° C, provide extra rollers as necessary to obtain required compaction before cooling.
    - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
  - .4 Place asphalt concrete in compacted lifts of thickness as indicated.
  - .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
  - .6 Spread and strike off mixture with self propelled mechanical finisher.
    - .1 Construct longitudinal joints and edges true to line markings. Position and operate paver to follow established line closely.
    - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 3 m apart.
    - .3 Maintain constant head of mix in auger chamber of paver during placing.
-

- .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
  - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
  - .6 Correct irregularities in surface of pavement course directly behind paver.
  - .7 Do not throw surplus material on freshly screeded surfaces.
  - .7 When hand spreading is used:
    - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
    - .2 Distribute material uniformly without broad casting material.
    - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
    - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
    - .5 Provide heating equipment to keep hand tools free from asphalt.
      - .1 Control temperature to avoid burning material.
      - .2 Do not use tools at higher temperature than temperature of mix being placed.
  - 3.5 Compacting
    - .1 Roll asphalt continuously using established rolling pattern for test strip and to density of not less than 97% of 75 blow Marshall density in accordance with ASTM D1559 with no individual test less than 95%.
    - .2 General:
      - .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
      - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
      - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
      - .4 Use static compaction for levelling coarse less than 25 mm thick.
-

- .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
  - .6 Overlap successive passes of roller by at least one half width of roller mm and vary pass lengths.
  - .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
  - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
  - .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
  - .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
    - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
  - .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
  - .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
  - .3 Breakdown rolling:
    - .1 Begin breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
    - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
    - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.
    - .4 Use only experienced roller operators.
  - .4 Intermediate rolling:
    - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
    - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
-

- .5 Finish rolling:
    - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
      - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
    - .2 Conduct rolling operations in close sequence.
  - 3.6 Joints
    - .1 General:
      - .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
      - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
      - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
    - .2 Transverse joints:
      - .1 Offset transverse joint in succeeding lifts by at least 600mm.
      - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
      - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
    - .3 Longitudinal joints:
      - .1 Offset longitudinal joints in succeeding lifts by at least 150mm.
      - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100° C prior to paving of adjacent lane.
        - .1 For airfield runway paving, avoid cold joint construction in mid 30 m of runway.
        - .2 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
      - .3 Overlap previously laid strip with spreader by 100 mm.
      - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
      - .5 Roll longitudinal joints directly behind paving operation.
-



- .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150mm extending onto previously placed and compacted lane.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.
  - .1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.
  - .2 Locate feather joints as indicated.
- .5 Construct butt joints as indicated.
- 3.7 Finish Intolerances
  - .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
  - .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.
- 3.8 Defective Work
  - .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
  - .2 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- 3.9 Cleaning
  - .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning

**END OF SECTION**

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**PART 1 - GENERAL**

- |                                   |    |  |
|-----------------------------------|----|--|
| 1.1 Measurement for Payment       | .1 | No separate payment will be made for dust control. Payment for dust control is considered as incidental to the work and to be included in the relevant unit prices in this contract. |
|                                   | .2 | Supply and apply calcium chloride as part of dust control only if directed to do so by the Departmental Representative.  |
| 1.3 References                    | .1 | Canadian General Standards Board (CGSB):   |
|                                   | .1 | CAN/CGSB-15.1, Calcium Chloride.   |
| 1.4 Delivery Storage and Handling | .1 | Supply calcium chloride in quantities and at times as directed by Departmental Representative.   |
|                                   | .2 | Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.   |
|                                   | .3 | Store bags of calcium chloride in weather-proof enclosures.  |
|                                   | .4 | Supply calcium chloride as 35% aqueous solution.   |
| 1.5 Waste Management and Disposal | .1 | Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.  |
|                                   | .2 | Place materials defined as hazardous or toxic in designated containers.  |

**PART 2 - PRODUCTS**

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|---------------|----|--|
| 2.1 Materials | .1 | Calcium chloride flakes: to CAN/CGSB-15.1, Type S: Grade 1 (77%), Class A.   |
|               | .2 | Aqueous calcium chloride: to CAN/CGSB-15.1, Class 1 or 2, 35% concentration by weight of anhydrous product.                  |
|               | .3 | Water: to Departmental Representative's approval.  |
|               | .4 | Aqueous magnesium chloride or calcium chloride may be used provided application is not in an environmentally harmful manner. |
|               | .5 | Lignosulphates and used oil or "cut back" bitumen products are not permitted.  |
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**PART 3 - EXECUTION**

- 3.1 Application
- .1 Control dust at all times for the duration of the Contract.
  - .2 Apply water and aqueous solutions with distributors equipped with means of shutoff and with spray systems to ensure uniform application.
  - .3 Apply aqueous solutions at the following rates:
    - .1 Calcium chloride (25%) at 2.4 L/sqm on roads not previously treated and 3.0 L/sqm for road stabilization.
    - .2 Calcium chloride (35%) or magnesium chloride (30%) at 1.6 L/sqm on roads not previously treated and 2.0 L/sqm for road stabilization.
  - .4 Apply flake calcium chloride uniformly at a rate of 1.00 kg/sqm unless otherwise directed.
  - .5 Immediately after applying calcium chloride flakes, apply water until calcium chloride spreads to edge of roadway.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Payment Procedure .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supplying and placing pavement markings as indicated in the Drawings and as directed by the Departmental Representative.
- .2 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities. Temporary marking tape to be considered incidental in the payment item.
- 1.2 References .1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.5, Low Flash Petroleum Spirits Thinner.
- .2 CAN/CGSB 1.74, Alkyde Traffic Paint.
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).
- 1.3 Action and Informational Submittals .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Samples:
- .1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.
- .1 Two 1 L samples of each type of paint.
- .2 One 1 kg sample of glass beads.
- .3 Sampling to CGSB 1-GP
- .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number, formulation number and batch number.
- 1.4 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Product Requirements.
-

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

## PART 2 - PRODUCTS

### 2.1 Materials

- .1 Paint:
  - .1 To CSGB 1-GP-74M, alkyd traffic marking.
  - .2 To CSGB 1-GP-149M, alkyd reflectorized traffic marking.
  - .3 Colour: to CSGB 1-GP-12C, yellow 505-308, black 512-301 and white 513-301.
- .2 Thinner: to CSGB 1-GP-5M.
- .3 Glass reflective beads: Overlay type to CSGB 1-GP-74M, suitable for application to wet paint surface for light reflectance.
- .4 Temporary pavement marking tape:
  - .1 Material composition shall be at the discretion of the manufacturer subject to the approval of the Departmental Representative. Each formulation shall be identified by a code number.
  - .2 The colour of the marking to be brilliant white or yellow at the discretion of the Departmental Representative. The brightness value shall exceed 70% for the white and 45% for yellow obtained with a Gardner Multi-purpose Reflectometer when measuring 0 - 45 degrees C daylight luminous directional reflectance with the green filter.

## PART 3 - EXECUTION

- 3.1 Examination
    - .1 Pavement surface to be dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
  - 3.2 Equipment Requirements
    - .1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.
    - .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.
  - 3.3 Application
    - .1 Lay out pavement markings.
    - .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is
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- less than 60 km/h and no rain is forecast.
- .3 Apply traffic paint evenly at rate of 3 m<sup>2</sup>/L.
  - .4 Do not thin paint unless approved by Departmental Representative.
  - .5 Symbols and letters to dimensions indicated.
  - .6 Paint lines: of uniform colour and density with sharp edges.
  - .7 Thoroughly clean distributor tank before refilling with paint of different colour.
  - .8 Apply glass beads at rate of 0.5 kg/l of painted area immediately after application of paint.
- 3.4 Tolerance .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- 3.5 Protection of Completed Work .1 Protect pavement markings until dry.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Payment Procedure .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply and installation of all traffic signage; relocation of signage, including posts, bases and hardware as indicated in the Drawings and as directed by the Departmental Representative.
- .2 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities.
- 1.2 References .1 ASTM International
- .1 ASTM B221M, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
- .2 ASTM B209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM D4956, Standard Specification for Retro-reflective Sheeting for Traffic Control
- .2 CSA Canadian Standards Association
- .1 CSA 0121M-1978, Douglas Fir Plywood
- .3 Sign Pattern Manual, British Columbia.
- .4 Specifications for Standard Highway Sign Materials, Fabrication and Supply – BC Ministry of Transportation and Infrastructure, latest edition.
- .5 2012 Standard Specifications for Highway Construction – BC Ministry of Transportation and Infrastructure, latest edition.
- 1.3 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

**PART 2 - PRODUCTS**

- 2.1 Materials .1 Signs
- .1 Must be retro-reflective to show the same colour, shape and message at night as they appear in daytime.
- .2 Conform to the Specifications for Standard Highway Sign Materials, Fabrication and Supply – BC Ministry of Transportation and Infrastructure, latest edition
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- .2 Posts
  - .1 Sign posts shall be perforated square steel tubing formed from 12 gauge, hot rolled steel, conforming to ASTM A101, Grade 50.
  - .2 Tubing shall be hot dipped galvanized conforming to ASTM A653 G-90 or CSA G164.
  - .3 Tubing shall have 7/16" holes on all four sides on 1" centres.
  - .4 Outside dimensions to conform to Drawing SP635-3.6.1, 2012 Standard Specifications for Highway Construction.
- .3 All hardware, nuts, bolts, washers, to be stainless steel.
- .4 Base to be concrete, pre-cast or poured-in-place, conforming to Drawing SP635-1.1.35 or Drawing SP635-1.1.44, 2012 Standard Specifications for Highway Construction.

### PART 3 - EXECUTION

#### 3.1 Installation

- .1 Concrete base shall be installed 25mm above finished grade except where installed in pavement it shall be flush with surface with no chamfered edge.
- .2 If poured-in-place, concrete to have attained a compressive strength of 30MPa prior to post installation.
- .3 All bases to have an inner sleeve.
- .4 Square tubing posts to be supplied in continuous lengths, with no splices, and shall be field cut to suit the particular installation. All field cuts to be painted with cold galvanizing compound.
- .5 Posts to be installed plumb.
- .6 Install sign to post and post to concrete base with hardware to conform to Drawing SP635-3.6.1, 2012 Standard Specifications for Highway Construction.

#### 3.2 Location

- .1 Lay out sign locations as per the Contract Drawings.
- .2 Sign location to be reviewed and approved by Departmental Representative prior to installation.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes
- .1 Excavation, Trenching and Backfilling to Section 31 23 33
  - .2 Aggregates to Section 31 05 16
- 1.2 Measurement for Payment
- .1 Payment for water main:
    - .1 Shall be full compensation for all work necessary and incidental for supply, installation by open cut or directional drill and testing of all water mains of pipe types and sizes indicated to lines, grades and cross section in accordance in the Drawings and as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: directional drill or open cut removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all water main piping and fittings, excluding valves and hydrants, supply, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment of this item shall be made at the unit price per lineal metre installed, as measured and accepted by the Departmental Representative.
  - .2 Payment for gate valves:
    - .1 Shall be full compensation for all work necessary and incidental for supply and installation of gate valves of types and sizes indicated in the Drawings and as directed by the Departmental Representative.
    - .2 Measurement for payment of this item shall be made at the unit price for each gate valve installed, as measured and accepted by the Departmental Representative.
  - .3 Payment for hydrant assemblies:
    - .1 Shall be full compensation for all work necessary and incidental for supply and installation of hydrant assemblies of types and sizes indicated in the Drawings and as directed by the Departmental Representative.
    - .2 Measurement for payment of this item shall be made at the unit price for each hydrant assembly installed, as measured and accepted by the Departmental Representative.
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- .4 Payment for water main testing:
    - .1 Shall be full compensation for all work necessary and incidental for the testing of all water mains as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: supply and installation of temporary test points; pressure testing, chlorinating, flushing and verification of all installed pipe; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities as accepted by the Departmental Representative.
  - .5 Payment for water main tie-ins:
    - .1 Shall be full compensation for all work necessary and incidental for the water main tie-ins (or connections) as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all water main piping and fittings, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; disinfection, swabbing of all installed pipe; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities for each tie-in location as accepted by the Departmental Representative.
- 1.3 References
- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
    - .1 ANSI/AWWA B300, Standard for Hypochlorites.
    - .2 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75mm through 1200mm), for Water.
    - .3 ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
    - .4 ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
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- .5 ANSI/AWWA C651, Disinfecting Water Mains.
  - .6 ANSI/AWWA C800, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
  - .7 ANSI/AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
  - .2 ASTM International
  - .3 American Water Works Association (AWWA) / Manual of Practice
    - .1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
  - .4 Canadian General Standards Board (CGSB)
  - .5 CSA International
- 1.4 Submittals
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit complete construction schedule for water mains. Include method for installation of water main.
  - .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .4 One week prior to start of laying pipe, Contractor to provide sieve analysis of the proposed bedding materials to the Department Representative for approval.
  - .5 Submit manufacturer's pipe certification
  - .6 Pipe certification to be on pipe. Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
    - .2 Pipe certification to be on pipe.
- 1.5 Installation Method
- .1 Contract Drawings indicate the pipe to be installed by both directional drill and open cut method.
  - .2 Contractor to install the pipe based on the method indicated on the Contract Drawings. The Contractor may change the method of installation at the discretion and approval of the Department Representative.
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- 1.6 Delivery and Storage
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Store materials off ground and in accordance with manufacturer's recommendations.
  - .4 Replace defective or damaged materials with new.
- 1.7 Scheduling of Work
- .1 Schedule Work to minimize interruptions to existing services.
  - .2 Submit schedule of expected interruptions to Department Representative for approval and adhere to interruption schedule as approved by Department Representative.
  - .3 Notify Department Representative a minimum of 48 h in advance of interruption in service.
  - .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
  - .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
  - .6 Provide "Out of Service" sign on hydrant not in use.
  - .7 Advise local police department of anticipated interference with movement of traffic.
- 1.8 Waste Management and Disposal
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
  - .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- 1.9 Closeout Submittals
- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 77 00 - Closeout Submittals.
    - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

**PART 2 - PRODUCTS**

- 2.1 Pipe, Joints and Fittings
- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end.
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- .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.
  - .2 Ductile Iron fittings: to ANSI/AWWA C153/A21.53-06.
  - .2 High Density Polyethylene pressure pipe: to ANSI/AWWA C906-07
    - .1 Pressure class as indicated
    - .2 Iron Pipe Size equivalent outside diameter
    - .3 To be compatible with specified mechanical joint fittings and valves without special adapters
  - .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 and in accordance with manufacturer's recommendations.
  - .4 Polyethylene fittings:
    - .1 Fabricated HDPE mitred fittings to AWWA C906 suitable for pressure rating specified
    - .2 Moulded HDPE fittings to ASTM 3261 suitable for pressure rating specified and fusion to main pipe.
    - .3 Flanged joints to AWWA C906 flat faced stud end and loose hot-dip galvanized ductile iron (ASTM A536) backup ring drilling to ANSI B16.1, ANSI B16.5, or AWWA C207, class suitable for pressure rating specified.
  - 2.2 Valves and Valve Boxes
    - .1 Valves to open counter clockwise.
    - .2 Gate valves: to ANSI/AWWA C500, standard iron body, bronze mounted valves with non-rising stems, suitable for 1 Pa with mechanical, flanged, push-on, grooved type joints.
    - .3 Air and vacuum release valves: heavy duty combination air release valves employing direct acting kinetic principle.
      - .1 Fabricate valves of cast iron body and cover, with bronze trim, stainless steel floats with shock-proof synthetic seat suitable for 2 MPa working pressure.
      - .2 Valves to expel air at high rate during filling, at low rate during operation, and to admit air while line is being drained.
      - .3 Valve complete with surge check unit.
      - .4 Ends to be flanged to ANSI/AWWA C110/A21.10.
    - 4 Mainline valve boxes to be as specified on the Contract Drawings: telescoping, cast iron, top flange type service box.
      - .1 Valve box riser to be 150 mm diameter PVC DR35 or better.
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- 2.3 Tracer Wire
- .1 Direct Burial #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
    - .1 Copperhead Directional Drill Wire or approved equal
  - .2 Tracer Box shall include:
    - .1 Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
    - .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A126-B requirements.
    - .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
    - .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
    - .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
    - .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.
- 2.4 Valve Chambers
- .1 Concrete to Section 03 40 01 - Precast Concrete.
  - .2 Precast concrete sections to ASTM C478M. Cast ladder rungs integral with unit; field installation not permitted.
  - .3 Valve chamber frames and covers:
    - .1 Design and dimensions as indicated.
    - .2 Cover to be marked "WATER"/"EAU".
  - .4 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CAN/CSA-G30.18, hot-dipped galvanized after fabrication to CAN/CSA-G164. Rungs to be safety pattern.
- 2.5 Service Connections
- .1 Copper tubing: to ASTM B 88M type K, annealed.
  - .2 Polyethylene pressure pipe:
    - .1 To CSA-B137.1, type PE, series 160, ASTM F714, Type PE, series DR 11.
    - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE, series 250.
  - .3 Copper tubing joints: compression type suitable for 1 MPa working pressure.
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- .4 Polyethylene pipe joints: thermal butt fusion welded.
  - .5 Brass corporation stops: compression type having threads to ANSI/AWWA C800.
  - .6 Brass inverted key-type curb stops: compression type with drains.
    - .1 Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury.
    - .2 Top of cast iron box marked "WATER"/"EAU".
  - .7 Polyethylene tapping tees or multi-saddle tees: for Polyethylene pipe. Tees to be socket fused to pipe.
  - .8 Service connections for PVC pipe:
    - .1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
    - .2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.
  - .9 Bronze type service clamps: for PVC pipe service connections.
    - .1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
    - .2 Clamps to be tapped with threads to ANSI/AWWA C800.
  - .10 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.
- 2.6 Yard Hydrants
- .1 Yard Hydrants: Terminal City self-draining stand pipe, factory assembled unit:
    - .1 Hydrants to open threads to local standard, Provide metal caps and chains.
    - .2 Yard Hydrant to be manufactured with bronze operating and draining components.
    - .3 The stuffing box and draining mechanism to have "O" ring rubber gaskets for sealing purposes.
    - .4 Polyurethane anti-score seating material is used for the valve disc facing.
    - .5 Provide key operated gate valve located 1m from hydrant.
    - .6 Depth of bury 1.2 m.
  - .2 Hydrant paint: exterior enamel to CAN/CGSB-1.88,MPI #96.
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- .1 Hydrant Body to be red.
  - .2 Caps and ports to be white.
- 2.6 Pipe Bedding and Surround Material .1 Pipe bedding and surround in accordance with Section 31 05 16 – Aggregates.
- 2.7 Backfill .1 Backfill in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- 2.8 Pipe Disinfection .1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.
- PART 3 - EXECUTION**
- 3.1 Preparation .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
- .1 Inspect materials for defects to approval of the Department Representative.
  - .2 Remove defective materials from site as directed by Department Representative.
- 3.2 Trenching .1 Do trenching work in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1.0 m from finished grade or as indicated.
  - .3 Trench alignment and depth require Department Representative approval prior to placing bedding material and pipe.
- 3.3 Granular Bedding .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150mm below bottom of pipe.
- .2 Do not place material in frozen condition.
  - .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
  - .4 Shape transverse depressions in bedding as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
  - .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
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**3.4 Pipe Installation**

- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .2 Join pipes in accordance with manufacturer's recommendations. Butt-fuse high density polyethylene in strict accordance with manufacturer's instruction by manufacturer or by manufacturer's trained personnel.
  - .3 Bevel or taper ends of PVC pipe to match fittings.
  - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .5 Lay pipes on prepared bed, true to line and grade.
    - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
    - .2 Take up and replace defective pipe.
    - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
  - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
  - .7 Do not exceed one half of permissible deflection at joints as recommended by pipe manufacturer. For HDPE pipe cold bending allowed to a minimum radius of 50 times nominal pipe size without special fittings.
  - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
    - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .9 Position and join pipes with equipment and methods approved by Department Representative.
  - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
  - .11 Align pipes before jointing.
  - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
    - .1 Remove disturbed or contaminated gaskets.
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- .2 Clean, lubricate and replace before jointing is attempted again.
  - .14 Complete each joint before laying next length of pipe.
  - .15 Minimize deflection after joint has been made.
  - .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
  - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Department Representative.
  - .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
  - .20 Install tracer wire along entire length of watermain with Test boxes located at maximum 1000m separation.
  - .21 Do not lay pipe on frozen bedding.
  - .22 Do hydrostatic and leakage test and have results approved by the Department Representative before surrounding and covering joints and fittings with granular material.
  - .23 Backfill remainder of trench. Ensure all polyethylene pipe is at temperature of surrounding soil when it is backfilled and compacted.
- 3.5 Valve Installation
- .1 Install valves to manufacturer's recommendations at locations as indicated.
- 3.6 Valve Chambers
- .1 Use precast units as approved by the Department Representative.
  - .2 Construct units as indicated, plumb and centered over valve nut, true to alignment and grade, and not resting on pipe.
  - .3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.
  - .4 Plug lifting holes with precast concrete plugs set in cement mortar.
  - .5 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
  - .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.
- 3.7 Service Connections
- .1 Terminate building water service 1 m outside building wall or as indicated opposite point of connection to main. Locate point of connection in advance and advise Department Representative.
  - .2 Cap or seal end of pipe and place temporary marker to locate pipe end.
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- .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
- .3 Construct service connections at right angles to water main unless otherwise directed.
- .4 Tappings on ductile iron, or PVC-C900 pipe, may be threaded without service clamps.
  - .1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.
  - .2 Tappings PVC-C900 pipe to conform to following:

Pipe Diameter	Max Tap without Clamp	Max Tap with Clamp
100 mm	20 mm	25 mm
150 mm	20 mm	40 mm
200 mm	25 mm	50 mm
250 mm	25 mm	50 mm
300 mm	40 mm	75 mm

- .5 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.
  - .6 Tappings for PE pipe: PE tapping tees or multi-saddle tees.
  - .7 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
  - .8 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
  - .9 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.
  - .10 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
  - .11 Leave corporation stop valves fully open.
  - .12 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
  - .13 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
  - .14 Install curb stop with corporation box on services NPS 2 or less in diameter.
    - .1 Equip larger services with gate valve and cast iron box.
    - .2 Set box plumb over stop and adjust top flush with final grade elevation.
    - .3 Leave curb stop valves fully closed.
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- .15 Place temporary location marker at ends of plugged or capped unconnected water lines.
    - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
    - .2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.
  
  - 3.8 Yard Hydrants
    - .1 Install yard hydrants at locations as indicated.
    - .2 Set hydrants plumb, with hose outlets parallel with edge of pavement with outlet facing roadway.
    - .3 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
    - .4 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
    - .5 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.
  
  - 3.9 Thrust Blocks and Restrained Joints
    - .1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Department Representative.
    - .2 Keep joints and couplings free of concrete.
    - .3 Do not backfill over concrete within 24 hours after placing.
    - .4 For restrained joints: only use restrained joints approved by Department Representative
  
  - 3.10 Hydrostatic and Leakage Testing
    - .1 Perform pressure and leakage testing of High Density Polyethylene (HDPE) piping to AWWA M55; no leakage allowed.
    - .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
    - .3 Notify Department Representative at least 24 hours in advance of proposed tests.
      - .1 Perform tests in presence of Department Representative.
    - .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
    - .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Department Representative.
    - .6 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes between joints
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with approved granular material placed as directed by Department Representative.

- .7 Leave hydrants, valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1035 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hours.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Leakage defined as the amount of water supplied in order to maintain test pressure for 2 hours.
- .18 Locate and repair defects if leakage is greater than amount specified.
- .19 Repeat test until leakage is within specified allowance for full length of water main.

### 3.11 Pipe Surround

- .1 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
  - .5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D 698.
  - .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.
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- 3.12 Backfill .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under roadways and pathways, compact backfill to at least 95% maximum density to ASTM D 698.

- 3.14 Flushing and Disinfection .1 Flushing and disinfecting operations: witnessed by Department Representative.
- .1 Notify Department Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear. The contractor shall supply all water for flushing and testing.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
150 mm and below	38
200 mm	75
250 mm	115
300 mm	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Department Representative approval, introduce strong solution of chlorine as approved by Department Representative into water main and ensure that it is distributed throughout entire system.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine application to be close to point of filling water main and to occur at same time.
- .9 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .10 Flush line to remove chlorine solution after 24 hours.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
- .1 Take samples daily for minimum of two days.
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- .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .3 Specialist contractor to submit certified copy of test results.
- .13 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .14 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- 3.15 Surface Restoration
  - .1 After installing and backfilling over water mains, restore surface as per the Contract Drawings as approved by the Department Representative.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes
- .1 Excavation, Trenching and Backfilling to Section 31 23 33
  - .2 Aggregates to Section 31 05 16
- 1.2 Measurement for Payment
- .1 Payment for sewer force main:
    - .1 Shall be full compensation for all work necessary and incidental for supply, installation by open cut or directional drill and testing of all sewer force mains of pipe types and sizes indicated to lines, grades and cross section in accordance in the Drawings and as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: directional drill or open cut by removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all sewer force main piping and fittings; supply, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment of this item shall be made at the unit price per lineal metre installed, as measured and accepted by the Departmental Representative.
  - .2 Payment for sewer force main testing:
    - .1 Shall be full compensation for all work necessary and incidental for the testing of all sewer force mains as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: supply and installation of temporary test points; pressure testing and verification of all installed pipe; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities as accepted by the Departmental Representative.
  - .3 Payment for sewer force main tie-ins:
    - .1 Shall be full compensation for all work necessary and incidental for the sewer force main tie-ins (or connections) as directed by the Departmental Representative.
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- .2 The prices bid shall include, but not be limited to: removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all main piping and fittings, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities for each tie-in location as accepted by the Departmental Representative.
- 1.3 References
- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
    - .1 ANSI/AWWA B300, Standard for Hypochlorites.
    - .2 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75mm through 1200mm), for Water.
    - .10 ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
    - .20 ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
    - .24 ANSI/AWWA C651, Disinfecting Water Mains.
    - .25 ANSI/AWWA C800, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
    - .26 ANSI/AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
  - .2 ASTM International.
  - .3 American Water Works Association (AWWA) / Manual of Practice
    - .1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
  - .5 Canadian General Standards Board (CGSB).
  - .6 CSA International.
- 1.4 Submittals
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit complete construction schedule for sanitary sewer force mains.
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- Include method for installation of sanitary sewer force main.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 One week prior to start of laying pipe, Contractor to provide sieve analysis of the proposed bedding materials to the Department Representative for approval.
- .5 Submit manufacturer's pipe certification.
- .6 Pipe certification to be on pipe. Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for [distribution piping materials] and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Pipe certification to be on pipe.
- 1.5 Installation Method
- .1 Contract Drawings indicate the pipe to be installed by both directional drill and open cut method.
- .2 Contractor to install the pipe based on the method indicated on the Contract Drawings. The Contractor may change the method of installation at the discretion and approval of the Department Representative.
- 1.6 Delivery and Storage
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Store materials off ground and in accordance with manufacturer's recommendations.
- .4 Replace defective or damaged materials with new.
- 1.7 Scheduling of Work
- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Department Representative for approval and adhere to interruption schedule as approved by Department Representative.
- .3 Notify Department Representative a minimum of 48 h in advance of interruption in service.
- .4 Do not interrupt service for more than 3 hours and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- 1.8 Waste Management and Disposal
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
- .2 Collect and separate for disposal packaging material for recycling in

accordance with Waste Management Plan.

- 1.9 Closeout Submittals .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, maintenance and operating instructions in accordance with Section 01 77 00 - Closeout Submittals.
- .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes and valve chambers.

## PART 2 - PRODUCTS

- 2.1 Pipe, Joints and Fittings .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end
- .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.
- .2 Ductile Iron fittings: to ANSI/AWWA C153/A21.53-06.
- .2 High Density Polyethylene pressure pipe: to ANSI/AWWA C906-07
- .1 Pressure class as indicated
- .2 Iron Pipe Size equivalent outside diameter
- .3 To be compatible with specified mechanical joint fittings and valves without special adapters
- .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 and in accordance with manufacturer's recommendations.
- .4 Polyethylene fittings:
- .1 Fabricated HDPE mitred fittings to AWWA C906 suitable for pressure rating specified
- .2 Moulded HDPE fittings to ASTM 3261 suitable for pressure rating specified and fusion to main pipe.
- .3 Flanged joints to AWWA C906 flat faced stud end and loose hot-dip galvanized ductile iron (ASTM A536) backup ring drilling to ANSI B16.1, ANSI B16.5, or AWWA C207, class suitable for pressure rating specified.
- 2.2 Tracer Wire .1 Direct Burial #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
- .1 Copperhead Directional Drill Wire or approved equal
- .2 Tracer Box shall include:
- .1 Tube material shall be of high grade ABS, or equivalent rigid
-

- plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
- .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A126-B requirements.
- .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
- .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
- .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
- .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.
- 2.3 Pipe Bedding and Surround .1 Pipe bedding and surround in accordance with Section 31 05 16 –  
Material Aggregates.
- 2.4 Backfill .1 Backfill in accordance with Section 31 23 33 - Excavating, Trenching  
and Backfilling.
- PART 3 - EXECUTION**
- 3.1 Preparation .1 Clean pipes, fittings, valves and appurtenances of accumulated debris  
and water before installation.
- .1 Inspect materials for defects to approval of the Department  
Representative.
- .2 Remove defective materials from site as directed by  
Department Representative.
- 3.2 Trenching .1 Do trenching work in accordance with Section 31 23 33 - Excavating  
Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1.0 m from  
finished grade or as indicated.
- .3 Trench alignment and depth require Department Representative  
approval prior to placing bedding material and pipe.
- 3.3 Granular Bedding .1 Place granular bedding material in uniform layers not exceeding 150  
mm compacted thickness to depth of 150mm below bottom of pipe.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface
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- for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
  - .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
- 3.4 Pipe Installation
- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .2 Join pipes in accordance with manufacturer's recommendations. Butt-fuse high density polyethylene in strict accordance with manufacturer's instruction by manufacturer or by manufacturer's trained personnel.
  - .3 Bevel or taper ends of PVC pipe to match fittings.
  - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .5 Lay pipes on prepared bed, true to line and grade.
    - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
    - .2 Take up and replace defective pipe.
    - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
  - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
  - .7 Do not exceed one half of permissible deflection at joints as recommended by pipe manufacturer. For HDPE pipe cold bending allowed to a minimum radius of 50 times nominal pipe size without special fittings.
  - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
    - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .9 Position and join pipes with equipment and methods approved by Department Representative.
  - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
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- .11 Align pipes before jointing.
  - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
    - .1 Remove disturbed or contaminated gaskets.
    - .2 Clean, lubricate and replace before jointing is attempted again.
  - .14 Complete each joint before laying next length of pipe.
  - .15 Minimize deflection after joint has been made.
  - .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
  - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Department Representative.
  - .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
  - .20 Install tracer wire along entire length of main with Test boxes located at maximum 1000m separation.
  - .21 Do not lay pipe on frozen bedding.
  - .22 Do hydrostatic and leakage test and have results approved by the Department Representative before surrounding and covering joints and fittings with granular material.
  - .23 Backfill remainder of trench. Ensure all polyethylene pipe is at temperature of surrounding soil when it is backfilled and compacted.
- 3.5 Valve Installation
- .1 Install valves to manufacturer's recommendations at locations as indicated.
- 3.6 Valve Chambers
- .1 Use precast units as approved by the Department Representative.
  - .2 Construct units as indicated, plumb and centred over valve nut, true to alignment and grade, and not resting on pipe.
  - .3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.
  - .4 Plug lifting holes with precast concrete plugs set in cement mortar.
  - .5 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
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- .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.
  - 3.7 Service Connections
    - .1 Terminate building sewer service 1 m outside building wall or as indicated opposite point of connection to main. Locate point of connection in advance and advise Department Representative.
      - .2 Cap or seal end of pipe and place temporary marker to locate pipe end.
    - .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of sewer force main.
    - .3 Construct service connections at right angles to sewer main unless otherwise directed.
    - .4 Tappings for PE pipe: PE tapping tees or multi-saddle tees.
    - .5 Place temporary location marker at ends of plugged or capped unconnected service lines.
    - .6 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
    - .7 Paint exposed portion of stake red with designation "SEWER SERVICE LINE" in black.
  - 3.8 Thrust Blocks and Restrained Joints
    - .1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Department Representative.
    - .3 Keep joints and couplings free of concrete.
    - .4 Do not backfill over concrete within 24 hours after placing.
    - .5 For restrained joints: only use restrained joints approved by Department Representative
  - 3.9 Hydrostatic and Leakage Testing
    - .1 Perform pressure and leakage testing of High Density Polyethylene (HDPE) piping to AWWA M55; no leakage allowed.
    - .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
    - .3 Notify Department Representative at least 24 hours in advance of proposed tests.
      - .1 Perform tests in presence of Department Representative.
    - .4 Where section of system is provided with concrete thrust blocks, conduct tests at least [5] days after placing concrete or [2] days if high early strength concrete is used.
    - .5 Test pipeline in sections not exceeding 365 m in length, unless
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otherwise authorized by the Department Representative.

- .6 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Department Representative.
- .7 Leave valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1035 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hours.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Leakage defined as the amount of water supplied in order to maintain test pressure for 2 hours.
- .18 Locate and repair defects if leakage is greater than amount specified.
- .19 Repeat test until leakage is within specified allowance for full length of main.

### 3.10 Pipe Surround

- .1 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
  - .5 Compact each layer from pipe invert to mid height of pipe to at least
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- 95% maximum density to ASTM D 698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.
- 3.11 Backfill
- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under roadways and pathways, compact backfill to at least 95% maximum density to ASTM D 698.
- 3.12 Surface Restoration
- .1 After installing and backfilling over mains, restore surface as per the Contract Drawings as approved by the Department Representative.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 General .1 The intent of this specification to supplement Section 33 11 01- Waterworks and Section 33 34 00 – Sanitary Sewer Force Mains.
- .2 This section defines the acceptable methods and materials for installing fibre optic conduit, sewage forcemain and water mains by the horizontal directional drilling method and the requirements for high density polyethylene (HDPE) pipe installed by directional drilling or in open cut trenches as indicated.
- 1.2 Basis of Payment .1 No measurement for payment will be made under this Section.
- 1.3 References .1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM F1962-99, Standard Guide for Use of Max-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.
- 1.4 Installation Plan Submission .1 At least 7 days prior to mobilizing equipment Contractor shall submit his detailed installation plan to the Department Representative. The plan shall include a detailed plan and profile of the bores and be plotted at a scale no smaller than 1:500.
- .2 The plan shall be signed and sealed by a Professional Engineer (P.Eng) experienced with the installation of pipeline with horizontal directional drilling and registered in the Province of British Columbia.
- .3 The plan shall also include a listing of major equipment and supervisory personnel and a description of the methods to be used.
- 1.5 Variations in Plan or Profile .1 The Contractor may request changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points. Proposed changes shall be submitted in writing to the Engineer and receive approval of the Engineer prior to construction.
- 1.6 Alignment .1 The proposed plan and profile installation locations are based on alignments to accommodate acquired easements, to avoid obstructions, to accommodate air release and flowout, and to properly maintain operation flow velocities.
- 1.7 Qualifications .1 Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least five (5) years' experience in this work. Furthermore, the Contractor shall have installed directionally drilled pipe at least as large as 300mm in diameter, and have performed installations at least 600m in length.
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**PART 2 - PRODUCTS**

- 2.1 General .1 High density polyethylene pipe to AWWA C906 with pressure class as indicated shall be used in HDD installations. All piping system components shall be the products of one manufacturer and shall conform to the latest edition of ASTM D1248, ASTM D3350, and ASTM F714.
- 2.2 Piping and Bends .1 Piping and Bends shall be extruded from a polyethylene compound and shall conform to the following requirements:
- .1 The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 4710 material with a cell classification of 335434C, or better.
  - .2 The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than two percent.
  - .3 The maximum allowable hoop stress shall be 5500KPa at 23°C.
  - .4 The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.
  - .5 The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as indicated.
  - .6 Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.
  - .7 Water pipe exterior shall be blue in color or contain blue striping.
- 2.3 Tracer Wire .1 Direct Burial #12 AWG Solid, steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
- .2 Tracer Box shall be included:
- .1 Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
  - .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A-126-B requirements.
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- .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
- .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
- .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
- .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.

### PART 3 - EXECUTION

- 3.1 General Procedures
    - .1 All polyethylene pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expense for the representative shall be paid for by the Contractor.
  - 3.2 Transportation
    - .1 Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged.
  - 3.3 Storage
    - .1 Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe.
    - .2 Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature condition.
    - .3 Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
  - 3.4 Handling Pipe
    - .1 The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects.
    - .2 Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used.
    - .3 Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints.
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- .4 Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.
  - .5 The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section. Waterproof nightcaps of approved design may be used but they shall also be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose. The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.
  - .6 Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.
- 3.5 General Installation
- .1 The Contractor shall install the pipelines by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.
  - .2 Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these Specifications.
  - .3 The Contractor shall prepare and submit a plan to the Department Representative for approval for insertion of the HDPE pipe into the opened bore hole. This plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.
  - .4 The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.
- 3.6 Joining Pipe Sections
- .1 Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.
  - .2 Pipes shall be joined to one another by means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.
  - .3 Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:
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- .1 A polyethylene “stub end” shall be thermally butt-fused to the ends of the pipe.
  - .2 Provide ASTM A240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.
  - .3 Stainless Steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after 4 hours.
- 3.7 Testing
- .1 The pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After this test, the water will be removed with pigs. Erosion prevention and dechlorination procedures will be used during removal and discharge of the water.
  - .2 Before pipe is filled with water, pipe bedding, concreting of all valves and fittings and backfilling to be completed as required in this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressure tests. Submit pipeline to a test of 1.5 x working pressure applied at the highest elevation in each section, with a minimum of 1380 kPa applied at lowest point of test section. Ensure that test pressure does not exceed pipe or thrust restraint design pressures. Maximum allowable leakage rate at test pressure to not exceed 1.25 litres per millimeter diameter of pipe per kilometer per 24 hour period. Minimum duration of test period to be 2 hours. Maximum test pressures should not exceed those specified in CSA B137.3 – Table 9.
- 3.8 Tolerances
- .1 Pipe installed by the directional drilled method must be located in plan as shown on the Drawings, and must be no shallower than shown on the Drawings unless otherwise approved.
  - .2 The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 10 meters. This “as built” plan and profile shall be updated as the pilot bore is advanced.
  - .3 The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure.
  - .4 The Contractor shall grant the Department Representative access to all data and readout pertaining to the position of the bore head and the fluid pressures and flows. When requested, the Contractor shall provide explanations of this position monitoring and steering equipment.
  - .5 The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position
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monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Department Representative.

- .6 Each exit point shall be located as shown with an over-length tolerance of 3 meters for directional drills of 300 linear meters or less and 12 meters for directional drills of greater than 300 linear meters and an alignment tolerance of 500mm horizontal (left/right) and 200mm vertical with due consideration of the position of the other exit points and the required permanent easement.
- .7 The alignment of each pilot bore must be approved by the Department Representative before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Department Representative may, at his option, require a new pilot boring to be made.
- .8 After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dens, buckles, gouges, and internal obstructions) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of 2.0m or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of 2.0m.

### 3.9 Ream and Pullback

- .1 Reaming: Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.
  - .2 Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.
  - .3 Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.
  - .4 The lead end of the pipe shall be closed during the pullback operation.
  - .5 Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent overstressing or buckling during the pullback operation. Such support/rollers shall be spaced at a maximum of 18m on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before
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pulling operations resume.

- .6 The contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.
- 3.10 Handling Drilling Fluids and Cuttings .1 During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into any waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into any waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.
- .2 Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the road ditch or any waterway.
- .3 The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these Specifications.
- .4 To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.
- .5 The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.
- .6 As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.
- 3.11 Drilling Operations .1 The Contractor shall prepare a plan to be submitted for Department Representative approval which describes the noise reduction program, solids control plant, pilot hole drilling procedure, the reaming operation, and the pullback procedure.
- .2 All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling.
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- .3 All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.
  - .4 Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 days prior to start and certified as double white band or better shall be used.
  - .5 A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the construction drawings.
  - .6 The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 10m interval). Deviations from the acceptable tolerances described in the Specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bores define the minimum depth and radius of curvature. The Contractor shall maintain and provide to the Engineer, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.
  - .7 Between the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 3 meters wide and 12 meters long centered on the planned exit point.
  - .8 During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.
  - .9 Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.
- 3.12 Environmental Provisions .1 The Horizontal Directional Drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent ditches or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste.
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- All excavated pits used in the drilling operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.
- .2 The Contractor shall visit the site in advance of tender and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.
  - .3 The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.
  - .4 Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.
  - .5 Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.
  - .6 Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50% of weight.
  - .7 Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.
- 3.13 Emergency Frac-Out Plan .1 The contract shall prepare an emergency frac-Out plan and submit to the Department Representative 1 week prior to the start of construction. The contractor shall include the following requirements.
- .1 Keep all material and equipment needed to contain and clean up drilling mud releases on site and readily accessible in the event of a frac-out.
  - .2 In the event of a Frac-Out, implements measures to stop work, contain the drilling mud and prevent its further migration into the watercourse and notify all applicable authorities, including the closest DFO office in the area. Prioritize cleanup activities
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- relative to the risk of potential harm and dispose of the drilling mud in a manner that prevents reentry into the watercourse,
- .3 Ensures clean up measures do not result in greater damage to the banks and watercourse than from leaving the drilling mud in place.
  - .4 In the event of a frac-out contact the Departmental Representative, Environmental Monitor and Parks Representative.
  - .5 Stabilize any waste materials removed from the work site to prevent them from entering a watercourse.
  - .6 Remediation of any disturbed areas will be directed by Environmental Monitor at the Contractor's cost.
- 3.14 Inspection and Cleanup .1 It is necessary to minimize any residual stresses or strains remaining in the pipe following the installation, due to the imposed pulling forces and potential thermal expansion or contraction. Thus, the pipe should be allowed to achieve mechanical and thermal equilibrium with its surroundings prior to cutting the pipe at either end. Premature cutting of the pipe may allow the ends to shrink back into the hole. The pipe may be cut after it has been verified that there has been insignificant movement at the pipe entry end and negligible residual tensile load at the drill rig end.
- .2 If any fluid or slurry was allowed to enter the pipe to serve as ballast, the fluid must be purged and the pipe thoroughly flushed and cleaned.
- 3.15 Surface Restoration .1 After installing and backfilling, restore surface to original condition as approved by the Department Representative.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for supply and installation of all pipe culverts of pipe types and sizes indicated to lines, grades and cross section in accordance with the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: excavation; disposal of surplus materials; temporary shoring as required; supply and installation of pipe culverts, including couplings, precast concrete endwalls; dewatering; supply, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material; reinstatement; cleaning; and all other work and materials incidental and necessary to complete the Work to provide a complete and functional system in accordance with the Drawings and to the satisfaction of the Departmental Representative.
- .3 Measurement for payment shall be all-inclusive for all respective pipework including fittings, endwalls and appurtenances and shall be paid at the unit rates tendered in the Schedule of Prices and Quantities and accepted by the Departmental Representative.
- 1.2 References .1 ASTM International
- .1 ASTM D2412, pipe stiffness.
- .2 ASTM F477, gaskets.
- .2 CSA International
- .1 CSA B182.8, HDPE pipe.
- 1.3 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .1 Store materials in accordance with manufacturer's recommendations.
- .2 Store and protect pipe and pipe material from damage.
- .3 Replace defective or damaged materials with new.
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**PART 2 – PRODUCTS**

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|-------------------------------------|----|---|
| 2.1 High Density Polyethylene       | .1 | Exterior pipe corrugation to be embossed with stiffness ratings as required by CSA B182.8.              |
|                                     | .2 | Pipe to have factory assembled spigot gaskets and integral bell joint features certified to CSA B182.8. |
|                                     | .3 | Pipe to have minimum stiffness of 320 kPa at 5% deflection, when tested in accordance with ASTM D241.   |
|                                     | .4 | Gaskets to meet requirements of ASTM F477.  |
| 2.3 Granular Bedding and Backfiller | .1 | Refer to Section 31 05 16 – Aggregates of specification for bedding and backfill materials.             |

**PART 3 - EXECUTION**

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|-----------------|----|---|
| 3.1 Examination | .1 | Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions. |
|                 | .1 | Visually inspect substrate in presence of Departmental Representative.  |
|                 | .2 | Inform Departmental Representative of unacceptable conditions immediately upon discovery.   |
|                 | .3 | Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.  |
| 3.2 Preparation | .1 | Temporary Erosion and Sedimentation Control:  |
|                 | .1 | Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent surroundings.  |
|                 | .2 | Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.   |
|                 | .3 | Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.   |
| 3.3 Trenching   | .1 | Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.  |
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- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.
  - 3.4 Bedding
    - .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
    - .2 Place 100 mm minimum thickness of approved, compacted granular bedding material on bottom of excavation.
    - .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
    - .4 Place bedding in unfrozen condition.
  - 3.5 Laying Pipe Culverts
    - .1 Begin pipe placing at downstream end.
    - .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
    - .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
    - .4 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.
  - 3.6 Joints
    - .1 Install rubber gasket joints in accordance with manufacturer's written recommendations.
    - .2 Ensure that spigot ends are fully entered into bell ends.
  - 3.7 Backfilling
    - .1 Backfill around and over culverts as indicated or as directed by Departmental Representative.
    - .2 Place granular backfill material in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
    - .3 Compact each layer to 95% maximum density to ASTM D698 taking special care to obtain required density under haunches.
    - .4 Protect installed culvert with minimum 600mm cover of compacted fill before heavy equipment is permitted to cross.
    - .5 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
    - .6 Place backfill in unfrozen condition.
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|--------------|----|--|
| 3.8 Fluming  | .1 | Assemble and install fluming as indicated.           |
|              | .2 | Set top edges of fluming flush with side slope.      |
| 3.9 Endwalls | .1 | Construct endwalls as shown on the Contract Drawings |

**END OF SECTION**

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## PART 1 - GENERAL

- 1.1 Precedence 1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Specifications document.
- 1.2 Definitions .1 “Department” shall mean Public Works and Government Services Canada and is abbreviated as “PWGSC”.
- .2 “Departmental Representative” shall mean a representative appointed by PWGSC for the purpose of execution of this Contract.
- .3 “Owner” shall mean Parks Canada.
- 1.3 Hierarchy of Documents .1 In the event of discrepancies, the hierarchy of documents shall be as follows, in descending order:
- .1 These Specifications.
- .2 If conflict arises between an item in these specifications and an item found in one of the Reference Documents (Appendices) the specification shall govern.
- .3 Any technical and manufacturer’s standard, Government Act, Regulation or Code of practice referred to in the contract documents shall be the version current at the time the contract is awarded.
- .2 In the event of a difference between scaled dimensions on Plans and the figures written thereon, the figures shall govern. In the event that two or more plans show conflicting information, the information on the most recently dated plan shall govern.
- .3 Any technical and manufacturer’s standard, Government Act, Regulation or Code of Practice referred to in the Contract documents shall be the version current at the time the Contract is awarded.
- 1.4 Codes, Bylaws, Standards .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments.
- .2 Perform work in accordance with the Canadian Standards Association; the American Society for Testing of Materials; or the British Columbia Building Code; whichever is applicable and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .3 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .4 Meet or exceed requirements of Contract documents, specified standards, codes, and referenced documents.
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- .5 In any case of conflict or discrepancy, the most stringent requirements shall apply.
- 1.5 Contract Documents
- .1 The Contract Documents, drawings and specifications, are intended to complement each other, and to provide for and include everything necessary for the completion of the Work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.
- .3 If anything is found by the Contractor to be missing from the Contract Documents immediately inform the Departmental Representative.
- 1.6 Other Contracts
- .1 Further Contracts may be awarded while this contract is in progress.
- .2 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .3 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of this Work.
- 1.7 Division of Specifications
- .1 The specifications are subdivided in accordance with the current 5 or 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.
- 1.8 Project Location
- .1 The project is located along Wick Road within the Pacific Rim National Park Reserve, British Columbia.
- 1.9 Time of Completion
- .1 Complete the fiber optic communication work to provide a fully functioning system within 8 weeks after Contract Award.
- .2 Complete the Work within 30 weeks after Contract Award.
- 1.10 Contract Method
- .1 Construct Work under a Unit Price Contract
- 1.11 Section Includes
- .1 In general, Work under this Contract covers the reconstruction of Wick Road from the Florencia Bay Access Road to the Wickaninnish Beach Access Road along with Kwisis parking lot improvements.
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- 1.12 Work Included .1 Work includes, but is not limited to:
- .1 Staging of construction and traffic accommodation plan.
  - .2 Reconstruction of roadways.
  - .3 Parking lot improvements including repaving.
  - .4 Installation of culverts and headwalls.
  - .5 Installation sanitary sewer forcemains and water mains.
  - .6 Coordination and communication with other Contractors and agencies involved with Project, if applicable.
  - .7 Management of the Environment.
- .2 "Green" requirements:
- .1 Use only environmentally responsible green materials/ products with no VOC emissions.
  - .2 Use materials/products containing highest percentage of recycled and recovered materials practicable - consistent with maintaining cost effective satisfactory levels of competition.
  - .3 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.
- .3 Unless specifically stated otherwise, the Work is to include the furnishing of all labour, materials, equipment, and services necessary to complete the Work. The intent is that the Contractor provides a complete Job.
- 1.13 Contractor's Responsibility .1 Give all required Notices and comply with all local, provincial, and federal laws, bylaws, ordinances, rules, regulations, codes, and orders relating to the Work which are or become in force during the Performance of the Work.
- .2 As Prime Contractor, coordinate all the Work and provide all labour, materials, equipment, and services necessary for delivery, storage, handling, protection, installation, removal, inspection, and replacement or maintenance as required to provide a complete Project.
- .3 All persons working for the Prime Contractor, including all sub-contractors, are required to attend a tailgate meeting with Park Administration personnel at the Pacific Rim National Park Administration Building regarding procedures for working within the Park. More than one meeting can be arranged to accommodate the Contractor's schedule and work forces.
- 1.14 Hours of Work .1 Restrictive as follows:
- .1 Notify Departmental Representative and Park Administration of all after hours work, including weekends and holidays.
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- 1.15 Work Schedule .1 Carry on work as follows:
- .1 Within 10 working days after Contract award, provide a "phasing bar chart" and a schedule showing anticipated progress stages and final completion of the Work within the time period required by the Contract documents. Indicate the following:
    - .1 Submission of shop drawings, product data, MSDS sheets, and samples.
    - .2 Commencement and completion of Work of each section of the specifications or drawings as outlined.
    - .3 Final completion date within the time period required by the Contract documents.
  - .2 Do not change approved Schedule - without notifying Departmental Representative.
  - .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.
- 1.16 Documents Required .1 Maintain 1 copy each of the following at the job site:
- .1 Contract drawings.
  - .2 Contract specifications.
  - .3 Addenda to Contract documents.
  - .4 Copy of approved work schedule.
  - .5 Reviewed/approved shop drawings.
  - .6 Change orders.
  - .7 Other modifications to Contract.
  - .8 Field test reports.
  - .9 Reviewed/approved samples.
  - .10 Manufacturers' installation and application instructions.
  - .11 One set of record drawings and specifications for "as-built" purposes.
  - .13 Current construction standards of workmanship listed in technical Sections.
  - .14 Project Safety Plan / Traffic Control Plan.
  - .15 Environmental Protection Plan
  - .16 Copy of approved Work schedule.
  - .17 Labour conditions and wage schedules.
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- 1.17 Regulatory Requirements
- .1 Obtain and pay for Building Permit, Certificates, Licenses, and other permits required by regulatory municipal, provincial or federal authorities to complete the work.
  - .2 Obtain a Park Business License to work within the Pacific Rim National Park.
  - .3 Obtain a Provincial Highway Use Permit for Highway 4 if equipment will be accessing the highway during the work.
  - .4 Provide inspection authorities with plans and information required for issue of acceptance certificates.
  - .5 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.
- 1.18 Contractor's Use of Site
- .1 Use of site:
    - .1 Exclusive and complete for execution of Work.
    - .2 Assume responsibility for assigned premises for performance of this Work.
    - .3 Be responsible for coordination of all Work activities on site, including the Work of other contractors engaged by the Departmental Representative.
  - .2 Do not unreasonably encumber site with material or equipment.
  - .3 Perform Work in accordance with Contract documents and ensure work is carried out in accordance with indicated phasing as follows:
    - .1 Site to be considered four work zones as follows:
      - .1 Wick Road straight section Sta 0+267 to Sta 1+675,
      - .2 Wick Road curve Sta 5+000 to Sta 5+260,
      - .3 One half the Kwisitis parking lot and access road,
      - .4 Remaining half of the Kwisitis parking lot.
    - .2 Only one section of the roadway and one section of the parking lot can be under construction at any one time.
    - .3 Paving to follow road and parking lot reconstruction in a timely manner. Paving to be commenced once areas have been deemed ready to pave by the Departmental Representative.
    - .4 Roadways to have temporary lane marking until such time of permanent road markings. Parking lot to have sufficient temporary markings to designate parking stalls and drive aisles to the satisfaction of Departmental Representative.
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- 1.19 Traffic Control .1 Provide a detailed Traffic Management Plan (TMP) with dedicated traffic control and pedestrian delineation for safety of motorists, pedestrians and bicycle traffic for all locations where roadways are affected by construction activities in accordance with Section 01 35 00 Special Procedures for Traffic Control.
- .2 Do not close any lanes of road or highway without written consent of the Departmental Representative. Contractor to keep one lane open to traffic at all times.
- .3 Full road closures are not permitted unless reviewed and accepted by the Departmental Representative, Parks and Public Works a minimum on three weeks prior to any planned road closure.
- 1.20 Examination .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Provide photographs of surrounding properties, objects and structures liable to be damaged or be the subject of subsequent claims.
- 1.21 Existing Services .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the authorities having jurisdiction.
- 1.22 Location of Equipment and Fixtures .1 Location of equipment, fixtures, and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual location.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.
- 1.23 Cutting and Patching .1 Cut existing surfaces only as required to accommodate new work and as directed by the Departmental Representative.
- .2 Remove items so shown or specified.
- .3 Do not cut, bore, or sleeve load-bearing members unless instructed to do so by the drawings and/or specifications.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Fit work airtight to pipes, sleeves, ducts and conduits.
- .6 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material,
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- colour, finish and texture.
- .7 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.
- 1.24 Setting Out Work
- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Assume full responsibility for dimensions, spacings, overall fit with field components, and exact locations of bolt holes and their spacings.
- .3 Provide devices needed to lay out and construct work.
- .4 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.
- 1.25 Quality of Work
- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 The workmanship, erection methods, and procedures to meet minimum standards set out in the applicable codes and standards.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.
- 1.26 Works Coordination
- .1 Coordinate work of subtrades:
- .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
- .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
- .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
- .1 Identify on coordination drawings, structural elements, services lines, rough-in points, and indicate location of services entrance to site.
- .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
- .4 Publish minutes of each meeting.
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- .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
  - .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
  - .7 Coordinate and plan for all necessary road/lane closures ahead of time.
  - .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
  - .4 Work cooperation:
    - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
    - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching, and removal or replacement of completed work.
    - .3 Ensure disputes between subcontractors are resolved.
  - .5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
  - .6 Maintain efficient and continuous supervision.
  - 1.27 Approval of Shop Drawings, Product Data and Samples
    - .1 In accordance with Section 01 33 00, submit the requested shop drawings, product data, MSDS sheets, and samples indicated in each of the technical Sections.
    - .2 Allow sufficient time for the following:
      - .1 Review of product data.
      - .2 Approval of shop drawings.
      - .3 Review of re-submission.
      - .4 Ordering of approved material and/or products.
  - 1.28 Project Meetings
    - .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
  - 1.29 Testing and Inspections
    - .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified in Section 01 45 00 – Quality Control.
    - .2 The Contractor will appoint and pay for the services of testing agencies and/or testing laboratories to meet the requirements specified in the Contract documents and where required for the following:
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- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.
  - .3 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
  - .4 Contractor shall notify Departmental Representative in advance of planned testing.
  - .5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
  - .6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
  - .7 The Departmental Representative may require, and pay for, additional inspection and testing services not included here.
  - .8 Provide Departmental Representative with 2 copies of testing laboratory reports and mill tests and certificates of compliance as soon as they are available.
- 1.30 As-Built Documents
- .1 The Departmental Representative in coordination with the Contractor will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for "as-built" purposes.
  - .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings, and shop drawings as changes occur.
- 1.31 Cleaning
- .1 Conduct daily cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
  - .2 Ensure cleanup of the work areas each day after completion of work.
  - .3 In preparation for inspections:
    - .1 Examine all sight-exposed interior and exterior surfaced and concealed spaces.
    - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces.
  - .4 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.
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- 1.32 Environmental Protection .1 Environmental protection to follow the environmental management plan entitled “Environmental Management Plan - Wick Road and Kwisisit Visitor Centre Parking Lot Upgrades”, prepared by Current Environmental, dated January 25, 2017.
- .2 Prevent extraneous materials from contaminating air, land, or water beyond construction area, by providing temporary enclosures during work.
- .3 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .4 Ensure proper disposal procedures in accordance with all applicable territorial regulations.
- 1.33 Archaeological / Heritage Areas .1 Significant archaeology impacts are not expected with this Work.
- .2 The Contractor is to provide immediate notice to the Departmental Representative if evidence of cultural resources or evidence of archeological finds are encountered during excavation / construction, and await the Departmental Representative’s written instructions before proceeding with any further Work.
- .3 Relics and antiquities and items of historical or scientific interest shall remain the property of Parks Canada. Protect such articles and request directives from Departmental Representative.
- 1.34 First Nations Ceremony .1 Prior to any Work at the site, the First Nations will conduct a ceremonial blessing of the project.
- .2 Representatives from the Contractor’s team are requested to attend the ceremony.
- 1.35 Additional Drawings .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 6 sets of Contract documents for use by the Contractor at no additional cost. Should more than 6 sets of documents be required the Departmental Representative will provide them at additional cost.
- 1.36 Additional Information .1 A general subsurface investigation report entitled “Wick Road and Kwisisit Parking Lot Upgrades Geotechnical Investigation”, prepared by Thurber Engineering Ltd., dated January 13, 2017, is included in the Contract Documents as an Attachment.
- .2 An environmental management plan entitled “Environmental Management Plan - Wick Road and Kwisisit Visitor Centre Parking Lot Upgrades”, prepared by Current Environmental, dated January 25, 2017, is included in the Contract Documents as an Attachment.
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- .3 The information contained in these reports, by its nature, cannot reveal all conditions which exist or can occur at the site. These reports are included for the Contractor's general information only, and no guarantee is given as to the completeness and accuracy of this information. Any actions or assumptions based on the information, recommendations or suggestions contained in this report are entirely the Contractor's responsibility.
- 1.37 System of Measurement .1 The metric system of measurement (SI) will be employed on this Contract.
- 1.38 Submission of Tender .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and is fully conversant with all conditions therein.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Scheduled preconstruction and progress meetings.
- 1.2 Description .1 Coordination of progress schedules, submittals, use of sites, temporary utilities, construction facilities, and construction Work, with progress of work by others under instructions of Departmental Representative.
- 1.3 Construction Project Meetings .1 The Departmental Representative will schedule and administer project meetings as deemed necessary throughout progress of the Work.
- .2 Agenda to include, but not limited to, the following:
- .1 Review and approval of minutes of previous meeting.
  - .2 Review of site safety and security issues.
  - .3 Review of Work progress since previous meeting.
  - .4 Field observations, problems, conflicts.
  - .5 Problems that impede construction schedule.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .11 Maintenance of quality standards.
  - .12 Review proposed changes for affect on construction schedule and on completion date.
  - .13 Environmental Issues including species at risk, critical habitat, and work in and about streams.
  - .14 Archeological issues including Culturally Modified Trees (CMT's) and historical sites.
  - .15 Animal sightings and encounters
  - .16 Other business
  - .17 Schedule next meeting
- .3 The Owner shall provide physical space and arrange for meetings.
- .4 The Departmental Representative will record minutes, including significant proceedings and decisions, identify action by parties, and set time and date for next progress meeting.
- .5 The Departmental Representative will reproduce and distribute minutes within 3 days after each meeting and transmit to meeting participants, affected parties not in attendance, and Contractor.
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- 1.4 Construction Organization and Start-up
- .1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
  - .2 Departmental Representatives and senior representatives of the Contractor, major Subcontractors (if applicable), field inspectors and supervisors will be in attendance.
  - .3 Establish time and location of meeting and notify parties concerned minimum 3 days before meeting.
  - .4 Agenda to include, but not limited to, the following:
    - .1 Appointment of official representative of participants in Work.
    - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 17 - Construction Progress and Reporting.
    - .3 Schedule of submissions in accordance with Section 01 33 00 - Submittal Procedures.
    - .4 Requirements for temporary facilities, storage sheds, utilities, etc. in accordance with Section 01 51 00 - Temporary Utilities.
    - .5 Site security in accordance with Section 01 52 00 - Construction Facilities.
    - .6 Environmental Issues (species at risk, critical habitat, work in and about streams.)
    - .7 Archeological issues (CMT's and historical sites.)
    - .8 Permitting and Environmental Requirements.
    - .9 Proposed suppliers and/or sub-contractors.
    - .10 Proposed hours of work per day and days per week Contractor will normally work.
    - .11 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
    - .12 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 - Closeout Procedures.
    - .13 Monthly progress claims, administrative procedures, photographs, and holdbacks.
    - .14 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 - Quality Control.
    - .15 Insurances and transcript of policies.
    - .16 Other business.
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- .5 Comply with Departmental Representative's allocation of mobilization areas of sites; for field offices and sheds, access, traffic, and parking facilities.
  - .6 During construction, coordinate use of sites and facilities with Departmental Representative.
  - .7 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
- 1.5 Schedules
- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 17 - Construction Progress and Reporting to Departmental Representative coordinated with Departmental Representative's project schedule.
  - .2 After review, revise and resubmit schedule to comply with revised project schedule.
  - .3 During progress of Work revise and resubmit as directed by Departmental Representative.
- 1.6 Submittals
- .1 Submit preliminary shop drawings and product data and samples in accordance with Section 01 33 00 - Submittal Procedures, for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Departmental Representative.
  - .2 Submit Environmental Protection Plans to Departmental Representative.
  - .3 Submit requests for payment for review, and for transmittal to Departmental Representative.
  - .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
  - .5 Process substitutions through Departmental Representative.
  - .6 Process change orders through Departmental Representative.
  - .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative.
- 1.7 Closeout Procedures
- .1 Notify Departmental Representative when Work is considered ready for Substantial Performance, in accordance with Section 01 77 00 – Closeout Procedures.
  - .2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.
  - .3 Comply with Departmental Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance.
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- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

**END OF SECTION**

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**PART 1 - GENERAL**

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|--------------------------|----|--|
| 1.1 Section Includes     | .1 | Schedule submittals required.  |
|                          | .2 | Progress Photographs.  |
| 1.2 Submittals           | .1 | At preconstruction meeting submit a detailed schedule bar chart listing work items and days to complete each item. Clearly show sequence and interdependence of construction activities. |
|                          | .2 | Submit letter ensuring that schedule has been prepared in coordination with major Subcontractors and suppliers, if applicable.   |
|                          | .3 | Update schedule at the end of each week and submit to the Departmental Representative.   |
| 1.3 Progress Photographs | .1 | Provide digital photographs with dates and descriptions on CD disk with progress reports. Relate dates and descriptions to photo file names in a separate text file on disk.             |
|                          | .2 | Number of photographs: minimum of 50 photos to cover all aspects of the work.  |
|                          | .3 | Viewpoints: determined by Contractor to provide history of work.   |
|                          | .4 | Frequency: with progress statement, at completion of each construction stage, and as directed by Departmental Representative.  |

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 This section includes but is not limited to the following:
- .1 Health and Safety Plan.
  - .2 Certificates and Transcripts.
  - .3 Survey and Quality Testing Reports.
  - .4 Warranties
- 1.2 Administrative .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
  - .3 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents.
  - .4 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
  - .5 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
  - .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
  - .7 Keep one reviewed copy of each submission on site.
- 1.3 Progress Photographs .1 Submit progress photographs in accordance with Section 01 32 17 - Construction Progress and Reporting.
- 1.4 Survey and Quality Testing Reports .1 Submit certified survey and quality testing reports with progress reports.

**END OF SECTION**

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**PART 1 - GENERAL**

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| 1.1 Section Includes        | .1 Traffic Management Plan.<br>.2 Informational and Warning Devices.<br>.3 Protection and Control of Public Traffic.<br>.4 Operational Requirements.   |
| 1.2 Description             | .1 Provide a detailed Traffic Management Plan (TMP) with dedicated traffic control and pedestrian delineation for safety of motorists, pedestrians and bicycle traffic for all locations where roadways are affected by construction activities.<br>.2 TMP shall be in prepared in accordance with the BC Ministry of Transportation and Infrastructure Traffic Management Manual for Work on Roadways, latest edition, and the 2012 Standard Specifications for Highway Construction.<br>.3 Provide all onsite and offsite traffic delay, traffic control, traffic and bypass route directional signage for the project.<br>.4 The plan shall be submitted to the Departmental Representative for approval. |
| 1.3 Special Provisions      | .1 One lane of traffic must be maintained at all times.<br>.2 Work within the Kwisis parking lot shall be staged such that one half of the parking stalls are available at any given time.<br>.3 Minimize the disruption and time of construction at the entrance to the Kwisis Visitor Centre.  |
| 1.4 Measurement for Payment | .1 The lump sum price bid for this item shall be full compensation for developing and implementing a traffic management plan to control vehicle, cycling and pedestrian movement within the work zone along Wick Road and the parking lots.<br>.2 Payment for special procedures for traffic control and accommodation shall be made at the lump sum unit price tendered for this item. Payment will be made as follows, 25% for the first Progress Payment, equal distribution of 50% of payment for the intermediate progress payments, and 25% for the last Progress Payment.   |
| 1.5 References              | .1 BC Ministry of Transportation and Infrastructure Traffic Management Manual for Work on Roadways, latest edition.<br>.2 The 2012 Standard Specifications for Highway Construction.   |
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- 1.6 Protection of Public Traffic
- .1 Comply with current requirements of Acts, Regulations, and By-Laws for traffic regulation or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
  - .2 Do not leave equipment on traveled roadways overnight.
  - .3 Do not close driving or parking areas without consulting Departmental Representative. Before re-routing traffic erect signs and traffic control devices.
  - .4 Contractor shall be required to control traffic when falling timber within distances of roads, parking areas, or paths as specified by WorkSafe BC.
- 1.7 Informational and Warning Devices
- .1 Provide, erect, and maintain signs, flashing warning lights, and other devices required to indicate construction activities and other temporary and unusual conditions resulting from Project Work that requires road user response as specified in “Traffic Management Manual for Work on Roadways”.
  - .2 All traffic and warning signs shall be bilingual. The English and French message shall be of equal size and at the same elevation, with English on the left and French on the right. Assistance in translation of construction and warning signs to French may be obtained from the Departmental Representative.
  - .3 Meet with Departmental Representative prior to commencement of Work to determine signs and other devices required for project.
- 1.8 Operational Requirements
- .1 Maintain existing conditions for traffic throughout period of Contract except when required for construction under Contract and when measures have been taken as specified herein and reviewed by Departmental Representative to protect and control public vehicle and pedestrian traffic.
  - .2 At the discretion of the Departmental Representative, the Contractor may be requested to modify the TMP to accommodate any irregularities or excessive congestion of traffic flow.
  - .3 Remove signs and barriers upon completion of the project.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 References
- .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 The Canadian Electric Code (as amended)
  - .4 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 CSA Z1006-10 Management of Work in Confined Spaces.
    - .5 CSA Z462- Workplace Electrical Safety Standard
  - 5 National Fire Code of Canada 2010 (as amended)
    - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
  - .6 American National Standards Institute (ANSI):
    - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
  - .7 Province of British Columbia:
    - .1 Workers Compensation Act, Part 3, Occupational Health and Safety.
    - .2 Occupational Health and Safety Regulation.
  - .8 Any Hazardous Materials Assessment Reports must be listed in this section
- 1.2 Related Sections
- .1 Refer to the following current Specification sections as required:
    - .1 Project Management: Section 01 31 19
    - .2 Construction Progress and Reporting: Section 01 32 17
    - .3 Submittal Procedures: Section 01 33 00
    - .4 Special Procedures for Traffic Control: Section 01 35 00
    - .5 Temporary Utilities: Section 01 51 00
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- .6 Construction Facilities: Section 01 52 00
  - .7 Temporary Barriers and Enclosures: Section 01 56 00
  
  - 1.3 Workers' Compensation Board Coverage
    - .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.
  
  - 1.4 Compliance with Regulations
    - .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
    - .1 Submit to Departmental Representative for review all submittals listed.
    - .2 Work affected by submittals shall not proceed until review(s) by Departmental representative is/are complete.
    - .3 Submit the following:
      - .1 Health and Safety Plan within 5 days after date of Notice to Proceed and prior to commencement of Work.
      - .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 On site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
    - .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 for review upon request.
    - .5 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:
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- .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 Assume responsibility as the Prime Contractor for Work under this Contract.
  - .2 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.
  - .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable federal, provincial, territorial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- 1.7 Health and Safety Coordinator
- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. The Health and Safety Coordinator must:
    - .1 Have site-related working experience.
    - .2 Have working knowledge of occupational Health and Safety regulations.
    - .3 Be responsible for completing all Health and Safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform Work.
    - .4 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
    - .5 Be on site during execution of work.
- 1.8 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.
- 1.9 Project/Site Conditions
- .1 Potential work hazards onsite include: overhead and buried electrical utilities, buried water mains, and local traffic.
  - .2 The Contractor is solely responsible for all utility detection and clearances prior to starting work.
  - .3 The Contractor will not rely solely upon the Contract Drawings or other information provided for utility locations.
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- 1.10 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.
  - 1.11 Work Permits
    - .1 Obtain permit(s) related to project before start of work.
  - 1.12 Filing of Notice
    - .1 The Contractor is to file Notice of Project with Provincial authorities prior to beginning of Work.
    - .2 Provide copies of all notices to the Department Representative.
  - 1.13 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.
        - .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.
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- .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment 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 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.
  - 1.14 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.
    - .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 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.
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- 1.15 Hazardous Products .1 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and provision of MSDSs acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
- .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00 – Submittal Procedures.
- 1.16 Electrical Safety Requirements .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
- .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with the Departmental Representative.
- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.
- 1.17 Fire Safety and Hot Work .1 Obtain Departmental Representative's authorization before any welding, cutting, straightening, or any other hot work operations can be carried out onsite.
- 1.18 Fire Safety Requirements .1 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.
- .2 Handle, store, use, and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
- 1.19 Unforeseen Hazards .1 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.
- 1.20 Posted Documents .1 Post legible versions of the following documents on site:
- .1 Health and Safety Plan.
- .2 Sequence of work.
- .3 Emergency procedures.
- .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
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- .5 Notice of Project.
- .6 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.
- .7 WHMIS documents.
- .8 MSDSs.
- .9 List of names of Joint Health and Safety Committee members, or Health and Safety Representative.
- .2 Post all MSDSs onsite, 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.
- 1.21 Meetings
  - .1 Schedule and administer a Health and Safety meeting with Departmental Representative prior to commencement of Work.
  - .2 Attend the Health and Safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
  - .3 Contractor to hold regular Health and Safety meetings onsite as required by applicable legislation.
  - .4 All Health and Safety documentation / meeting minutes completed by the Contractor are to be forwarded to the Departmental Representative.
- 1.22 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 issues identified.
  - .3 The Departmental Representative may issue a "stop work order" if non-compliance with 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**

- 1.1 Measurement for Payment .1 Payment for environmental procedures:
- .1 Payment for the Contractor to implement environmental procedures outlined in the Environmental Management Plan (EMP) as directed by the Environmental Monitor and the Departmental Representative will be at a “time and materials” basis and paid through a Contract Change Order with the exception of erosion control.
  - .2 The Contractor is required to provide and store, on-site, the “required equipment and supplies” as outlined in the EMP. Costs associated with the equipment and supplies will only be considered if/and when they are implemented.
  - .3 There will be no consideration for any other additional payment, including shut downs due to heavy rain events, for the Contractor other than Item 1.1.1.1 to implement the environmental procedures.
- .2 Payment for erosion control:
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supplying and placing of erosion control blanket on all exposed banks and surfaces as directed by the Environmental Monitor and the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: supply and installation of erosion control blanket and retaining staples or pins, if required, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the unit price for each square meter of erosion control blanket installed as measured and accepted by the Departmental Representative. Overlap to be considered incidental in the payment item.
- 1.2 References .1 Environmental management plan (EMP) entitled ”Environmental Management Plan - Wick Road and Kwisitit Visitor Centre Parking Lot Upgrades”, prepared by Current Environmental, dated January 25, 2017.
- 1.1 Definitions .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.
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- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .3 Invasive plants: are any alien plant species that have the potential to pose undesirable or detrimental impacts on humans, animals or ecosystems. Invasive plants have the capacity to establish quickly and easily on both disturbed and un-disturbed sites, and can cause widespread negative economic, social and environmental impacts.
- .4 Noxious weeds: are invasive plants that have been designated under the BC Weed Control Act. This legislation imposes a duty on all land occupiers to control a set list of identified invasive plants.  
[www.agf.gov.bc.ca/cropprot/noxious.htm](http://www.agf.gov.bc.ca/cropprot/noxious.htm)
- 1.2 Regulatory Overview .1 Comply with all applicable environmental laws, regulations and requirements of Federal, Provincial, and other regional authorities, and acquire and comply with such permits, approvals and authorizations as may be required.
- 1.3 Site Access and Parking .1 The Contractor shall park employee vehicles and equipment in an area designated by the Departmental Representative.
- 1.4 Erosion control .1 Erosion control measures that prevent sediment from entering any waterway, in the vicinity of the construction site.
- .2 Erosion control measures must be in compliance with both Federal and Provincial legislation and directives from the EMP where required. Contractors should be referencing the provincial MOE Standards and Best Practices for Instream Works (2004) for best management practices in sediment and erosion control during construction activities.
- 1.5 Pollution Control .1 The Contractor shall prevent any sediment, deleterious and objectionable materials from entering streams, rivers, wetlands, water bodies or watercourses that would result in damage to aquatic and riparian habitat. Hazardous or toxic products shall be stored no closer than 100 metres to any surface water.
- .2 The Contractor shall prevent blowing dust and debris by providing dust control for on-site work by methods that are approved by the Departmental Representative.
- .3 The Contractor shall provide spill kits, to the satisfaction of the Departmental Representative, at refueling, lubrication and repair locations that will be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order on the
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- construction site. The Contractor and site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- .4 Timely and effective actions shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The Departmental Representative shall be notified immediately of any spill as well as the provincial authorities.
- .5 In the event of a spill, the Contractor shall prioritize the clean-up and all other work shall be stopped, where appropriate, and personnel devoted to spill containment and clean up.
- .6 The costs involved in a spill incident (control, clean up, disposal of contaminants, and site remediation to pre-spill conditions), shall be the responsibility of the Contractor. The site will be inspected to ensure completion to the pre-spill condition to the satisfaction of the Departmental Representative.
- 1.6 Equipment Maintenance, Fueling and Operation
- .1 The Contractor shall ensure that all soil, seeds and any debris attached to construction equipment to be used on the project site shall be removed (e.g. power washing) outside before delivery to the work site.
- .2 Equipment fueling site will be identified by the Contractor to the satisfaction of the Departmental Representative. On site storage of fuel shall not be allowed.
- .4 Mobile fuel containers (e.g. slip tanks, small fuel carboys) shall remain in the service vehicle at all times.
- .5 Equipment use on the project shall be fueled with E10, and low sulphur diesel fuels where available, and shall conform to local emission requirements. The Contractor is to ensure that unnecessary idling of the vehicles is avoided.
- .6 Oil changes, lubricant changes, greasing and machinery repairs shall be performed at locations satisfactory to the Departmental Representative. Waste lubrication product (e.g. oil filters, used containers, used oil, etc.) shall be secured in spill-proof containers and properly recycled or disposed of at an approved facility. No waste petroleum, lubricant products or related materials are to be discarded, buried or disposed of in borrow pits, turnouts, picnic areas, viewpoints, etc. or anywhere within the work area.
- .7 The Contractor shall ensure that all equipment is inspected daily for fluid/fuel leaks and maintained in good working condition.
- .8 Fuel containers and lubricant products shall be stored only in secure locations to the satisfaction of the Departmental Representative. Fuel tanks or other potential deleterious substance containers shall be secured to ensure they are tamperproof and cannot be drained by vandals when left overnight. Alternatively, the Contractor may hire a security person employed to prevent vandalism.
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- 1.7 Operation of Equipment
- .1 Equipment movements shall be restricted to the “footprint” of the construction area.
  - .2 When, in the opinion of PWGSC, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the designated work area, the Contractor shall be responsible, at his or her expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc. to the satisfaction of the Departmental Representative.
  - .3 Restrict vehicle movements to the work limits.
- 1.8 Managing Invasive Plant Vegetation
- .1 Keep equipment clean and wash equipment prior to mobilization to site.
  - .2. Imported material must be free from vegetation and seeds.
  - .3 Only use clean road material from invasive plant-free borrow pits and quarries.
  - .4 Conduct an inspection of any fill material source to identify any potential invasive species issues.
- 1.9 Fire Prevention and Control
- .1 A fire extinguisher shall be carried and available for use on each machine.
  - .2 Construction equipment shall be operated in a manner and with all original manufacturers’ safety devices to prevent ignition of flammable materials in the area.
  - .3 Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented.
  - .4 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. The Departmental Representative shall be notified of any fire immediately as well as the applicable Provincial Authorities. Basic instruction and phone numbers will be provided on-site by the Contractor and will be discussed in the project start-up meeting.
  - .5 Fires or burning of waste materials is not permitted.
- 1.10 Relics and Antiquities
- .1 Artifacts, relics, antiquities, and items of historical interest such as cornerstones, commemorative plaques, inscribed tablets and any objects found on the work site that may be considered artifacts shall be reported to the Departmental Representative immediately. The Contractor and workers shall wait for instruction before proceeding with their work.
  - .2 All historical or archaeological objects found are protected under federal Acts and regulations. The Contractor and workers shall stop work and protect any articles found and request direction from the Departmental Representative.
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- 1.11 Waste Materials Storage and Removal .1 The Contractor and workers shall dispose of hazardous wastes in conformance with the applicable federal and provincial regulations.
- .2 All wastes originating from construction, trade, hazardous and domestic sources, shall not be mixed, but will be kept separate.
- .3 Construction, trade, hazardous waste and domestic waste materials shall be contained and removed and disposed of at an appropriate off site waste landfill.
- .4 A concerted effort shall be made by the Contractor and workers to reduce, reuse and recycle materials where possible.
- .5 Sanitary facilities, such as portable container toilets, shall be provided by the Contractor and maintained in a clean condition.
- 1.12 Wastewater Discharge Criteria .1 Wash water, contaminated groundwater, and/or any other liquid effluent stream will be released onto the ground at a location that is a minimum of 30 metres from natural drainage courses and will conform to the discharge requirements set out in the provincial Water Act Permit:
- .2 Contractor must obtain approval from the provincial Water Act Officer prior to discharging any treated wastewater.
- 1.13 Drainage .1 Provide temporary drainage as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- 1.14 Environment Protection Supplies .1 Comply with federal and provincial fisheries and environmental protection legislation, including preventing the loss or destruction of fish habitat, and minimizing the impact of sedimentation, siltation or otherwise causing a degradation in water quality.
- .2 Supply, transport, install and maintain erosion, sediment and drainage controls necessary to complete the Work in accordance with the requirements of Departmental Representative.
- .3 Provide inventory of environmental protection supplies prior to mobilization.

## PART 2 - PRODUCTS

- 2.1 Material .1 Erosion Control Blanket (ECB):
- .1 Composed of coconut fibres bound together with natural biodegradable netting.
- .2 Supplied in rolls.
- .3 Mass/Unit Area, minimum 322g/m<sup>2</sup>.
-

- .4 Tensile strength to ASTM D6818, minimum MD of 4.5kN/m and CD of 3.6kN/m.
- .5 Elongation to ASTM D6818, 20% / 20%
- .6 Based on general physical properties outlined above, the equivalent ECB would be Layfield EG-2C (NN).

### PART 3 - EXECUTION

#### 3.1 Installation

- .1 Prepare subgrade by grading to provide a smooth, uniform surface. Remove all stumps, large rock, brush or other debris that could damage the fabric. Fill all holes and depressions so that the fabric does not bridge them. Replace loose or unstable soils.
- .2 Place erosion control blanket on all exposed surfaces.
- .3 Dig a 150mm x 150mm anchor trench both upslope and downslope of the area to be covered.
- .4 Secure the blanket with staples or pins into the trench every 300mm and backfill and compact.
- .5 Roll the blankets vertically down the slope or in the direction of the of flow for channels in a loose fashion and free of tension stress, folds, wrinkles and creases.
- .6 Overlap blankets a minimum 150mm in accordance with manufacturer's recommendations with downslope blanket underneath upslope blanket to form a shingle pattern.
- .7 Staple the blanket at 600mm x 600mm spacing in accordance with the manufacturer's recommendations. Pattern may differ for steeper slopes.
- .8 Replace damaged or deteriorated blanket to approval of Departmental Representative.

#### 3.2 Protection

- .1 No vehicles permitted directly on the erosion control blanket.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Quality Control Plan .1 Prepare and submit to Departmental Representative for review and approval a Quality Control Plan in accordance with Section 01 33 00 – Submittal Procedures, prior to project startup.
- 1.2 Measurement for Payment .1 No separate payment will be made for quality assurance, surveying, and testing. Payment for quality control is considered as incidental to the work and to be included in the relevant unit prices in this contract.
- 1.3 Inspection .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- 1.4 Independent Inspection Agencies .1 Appoint and pay for services of third-party Independent Quality Assurance testing laboratory and field staff including as follows:
- .1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.
- .2 Inspection and testing performed for Contractor's convenience.
- .3 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
- .4 Additional tests at the rates specified as follows:
- .1 Granular Base
- .1 Compaction: 1 test / 250 m<sup>2</sup>
- .2 Sieve: 1 test / material source / 1000 m<sup>3</sup>
- .2 Granular Sub-Base
- .1 Compaction: 1 test / 250 m<sup>2</sup>
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- .2 Sieve: 1 test / material source / 1000 m<sup>3</sup>
      - 3. Culvert Trench Backfill
        - .1 Compaction: 1 test / trench
    - .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
    - .3 Provide equipment required for inspection and testing by appointed agencies.
    - .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
    - .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.
  - 1.5 Access to Work
    - .1 Allow inspection/testing agencies access to Work.
    - .2 Cooperate to provide reasonable facilities for such access.
  - 1.6 Procedures
    - .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
    - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
    - .3 Provide labour and facilities to obtain and handle samples and materials onsite. Provide sufficient space to store test samples.
  - 1.7 Rejected Work
    - .1 Remove defective Work, whether result of poor workmanship, use of defective products, or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
    - .2 Make good other Contractor's work damaged by such removals or replacements promptly.
    - .3 If in opinion of the Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the Departmental Representative may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, with the amount determined by the Departmental Representative.
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- 1.8 Surveys
- .1 The Contractor shall be responsible for all layout and construction survey to complete the work.
  - .2 The Contractor shall submit a red line as-built drawing of the work to the Departmental Representative upon completion of the work. An electronic as-built survey will be acceptable in place of a red line drawing.
- 1.9 Reports
- .1 Submit 1 copy of inspection and test reports to Departmental Representative with all progress reports or, generally, as reports become available.
  - .2 Provide copies to Subcontractor of Work being inspected or tested and to manufacturer or fabricator of material being inspected or tested.

**END OF SECTION**

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**PART 1 - GENERAL**

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| 1.1 Section Includes                   | .1 | Temporary utilities.  |
| 1.2 Installation and Removal           | .1 | Provide temporary utilities in order to execute Work expeditiously.   |
|  | .2 | Remove from site all such work after use.   |
| 1.3 Water Supply                       | .1 | Provide continuous temporary supply of potable water for construction use, if applicable.   |
|  | .2 | Remove or decommission temporary water supply facilities upon completion of project.  |
| 1.4 Sanitary Facilities                | .1 | Provide sanitary facilities for construction use.   |
|  | .2 | Remove temporary sanitary facilities upon completion of project.  |
| 1.5 Temporary Power and Light          | .1 | Provide and pay for temporary power during construction for temporary lighting and operating of power tools and for construction use.           |
|  | .2 | Arrange for connection with appropriate utility company or Departmental Representative. Pay all costs for installation maintenance and removal. |
| 1.6 Temporary Communication Facilities | .1 | Provide and pay for temporary telephone necessary for own use.  |
| 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 onsite.   |

**END OF SECTION**

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**PART 1 - GENERAL**

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|-------------------------------------|----|---|
| 1.1 Section Includes                | .1 | Construction access and parking.  |
| 1.2 Installation and Removal        | .1 | Provide construction facilities in order to execute work expeditiously.   |
|                                     | .2 | Remove from all sites all such facilities after use.  |
| 1.3 Site Storage                    | .1 | Confine Work and operations of employees to only that which is required by the Contract Documents.  |
|                                     | .2 | Do not unreasonably encumber premises with products.  |
| 1.4 Construction Access and Parking | .1 | Parking will be permitted onsite provided it does not disrupt performance of Work.  |
|                                     | .2 | Provide and maintain adequate access to project site.   |
|                                     | .3 | Existing roads and temporary access roads will be used for access to the project site. Maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.  |
| 1.5 Sanitary Facilities             | .1 | Provide sanitary facilities for work force in accordance with governing regulations and ordinances.   |
|                                     | .2 | Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.   |
| 1.6 Construction Signage            | .1 | Signs and notices for health, safety, traffic control, instruction, etc. shall be in both official languages unless symbolic in nature. See Sections 01 35 33, Health and Safety, and 01 35 00, Special Procedures for Traffic Control, of these Specifications for more information. |
|                                     | .2 | Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.  |
|                                     | .3 | No other signs or advertisements, other than those required in the contract, shall be permitted within the park boundary.   |

**END OF SECTION**

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**PART 1 - GENERAL**

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|---|----|--|
| 1.1 Section Includes                            | .1 | Barriers.  |
|   | .2 | Traffic Controls.  |
| 1.2 Installation and Removal                    | .1 | Provide temporary controls in order to execute Work expeditiously.   |
|   | .2 | Remove from all sites all such work after use.   |
| 1.3 Protection for Trees                        | .1 | Protect trees and plants designated to remain. Protect from damage by equipment and construction procedures.                                       |
|   | .2 | Replace any trees designated for saving in kind that are damaged during construction.  |
| 1.4 Access to Site                              | .1 | Maintain existing access roads required for access to Work.  |
| 1.5 Public Traffic Flow                         | .1 | Provide and maintain competent signal flag operators, traffic signals, barricades and flashers as required to perform Work and protect the public. |
| 1.6 Fire Routes                                 | .1 | Maintain access to property for use by emergency response vehicles.  |
| 1.7 Protection for Off-Site and Public Property | .1 | Protect surrounding private and public property from damage during performance of Work.  |
|   | .2 | Be responsible for damage incurred.  |
| 1.8 Protection of Structure Finishes            | .1 | Provide protection for existing structures during performance of Work.   |
|   | .2 | Be responsible for damage incurred due to lack of or improper protection.  |

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Products and Materials
- .1 Use new products and materials unless otherwise specified.
  - .2 Use products of one manufacturer for material of the same type or classification unless otherwise specified.
  - .3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
  - .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.
  - .5 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.
  - .6 Prevent damage, adulteration, and soiling of products during delivery, handling, and storage. Immediately remove rejected products from site.
  - .7 Store products in accordance with suppliers' instructions.
  - .8 Touch-up damaged finished surfaces to Departmental Representative's satisfaction.
  - .9 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- 1.2 Quality of Products
- .1 Products, materials, and articles (referred to as products throughout Specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source, and quality of Products provided.
  - .2 Defective products will be rejected regardless of previous inspections.
    - .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
    - .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
  - .3 Retain purchase orders, invoices, and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
  - .4 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
  - .5 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the site.
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- 1.3 Availability of Products .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.
- .3 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.
- 1.4 Manufacturer's Instructions .1 Unless otherwise indicated in Specifications, install or erect products in accordance with manufacturer's instructions.
- .1 Do not rely on labels or enclosures provided with products.
- .2 Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between Specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- .4 Provide Manufacturer's instructions and specifications to Departmental Representative for review prior to any installations.
- 1.5 Contractor's Options .1 Products are specified by "Prescriptive" specifications: select any for Selection of product meeting or exceeding specifications.  
Products for Tendering
- .2 Products specified under "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
- .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Products. Alternative products may be considered provided full technical data is received in writing by Departmental Representative.
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- .5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.
- 1.6 Substitution After Contract Award
- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
- .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by the Departmental Representative if:
- .1 products selected by tenderer from those specified are not available;
- .2 delivery date of products selected from those specified would unduly delay completion of Contract, or
- .3 alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
- .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the Project. Pay for design or drawing changes required as result of substitution.
- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.
- 1.7 Transportation
- .1 Pay costs of transportation of products required in performance of Work.
- 1.8 Quality of Work
- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.
- 1.9 Coordination
- .1 Ensure cooperation of workers during Work. Maintain efficient and continuous supervision.
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- 1.10 Remedial Work
- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
  - .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

## PART 2 - PRODUCTS

- 2.1 Acceptable Products
- .1 Submit product data sheets for all manufactured products used in the Work to Departmental Representative for review in accordance with Section 01 33 00, Submittal Procedures.
  - .2 Use best quality products.

**END OF SECTION**

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**PART 1 - GENERAL**

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|-------------------------|----|---|
| 1.1 Section Includes    | .1 | Progressive cleaning.   |
|                         | .2 | Final cleaning.   |
| 1.2 Project Cleanliness | .1 | Maintain Work in tidy condition, free from accumulation of waste products and debris.   |
|                         | .2 | Remove waste materials from sites at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials onsite.  |
|                         | .3 | Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.  |
|                         | .4 | Ensure that no evasive species of vegetation are brought into the Park or are transported from one location to another within the Park. Make arrangements to provide only uncontaminated products for use. This may include using washed materials or materials using only clean blast rock. Machinery and equipment shall be thoroughly cleaned before moving between locations. |
| 1.3 Final Cleaning      | .1 | When Work is Substantially Performed, remove surplus products, tools, construction machinery, and equipment not required for performance of remaining Work.   |
|                         | .2 | Remove all waste products and debris.   |
|                         | .3 | Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.  |

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Waste Management Work Plan.
- 1.2 Definitions .1 Waste Management Coordinator (WMC): Designate individual who is in attendance onsite full-time. Designate, or have designated individuals from each Subcontractor to be responsible for waste management related to their trade and for coordinating activities with WMC.
- .2 Waste Audit (WA): Relates to projected waste generation. Involves measuring and estimating quantity and composition of waste, reasons for waste generation, and operational factors that contribute to waste.
- .3 Waste Reduction Workplan (WRW): Written report that addresses opportunities for reduction, reuse, or recycling of materials.
- .4 Materials Source Separation Program (MSSP): consists of a series of ongoing activities to separate reusable and recyclable waste materials into material categories from other types of waste at point of generation.
- 1.3 Documents .1 Maintain at the job site one copy of following documents:
- .1 Waste Management Workplan.
- 1.4 Use of Site and Facilities .1 Locate waste, refuse, recycling, etc. containers in locations to facilitate deposit of materials without hindering daily operations.
- .2 Locate separated materials in areas which minimize material damage.
- 1.5 Submittal .1 Submit requested submittals in accordance with Section 01 33 00, Submittal Procedures.
- .2 Prepare and submit the following submittals within 7 days of the Award of Contract:
- .1 Submit 3 copies of completed Waste Management Workplan (WMW).
- .3 Provide Departmental Representative with receipts indicating quantity of material delivered to landfill.
- .4 Provide Departmental Representative with receipts indicating quantity and type of materials sent for recycling.
- 1.6 Waste Management Workplan .1 Structure WMW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .2 Describe management of waste.
- .3 Identify opportunities for reduction, reuse, and/or recycling (3Rs) of materials.
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- .4 Post workplan or summary where workers at site are able to review its content.
- 1.7 Waste Processing Sites .1 Provide waste processing sites as applicable within the Province of British Columbia to Departmental Representative within 14 days of the Award of Contract.
- 1.8 Disposal of Wastes .1 Burying of rubbish and waste materials is prohibited unless approved by Departmental Representative at off-site locations obtained by the Contractor.  
.2 Burning of rubbish and waste materials is prohibited unless permitted by British Columbia Ministry of Forests. Permit to be obtained by the Contractor.  
.3 Disposal of waste volatile materials, mineral spirits, oil, paint thinner, etc. into waterways or by dumping onsite is prohibited.
- 1.9 Storage and Handling .1 Store, materials to be reused, recycled, and salvaged in locations obtained by the Contractor and accepted by Departmental Representative.  
.2 Unless specified otherwise, materials for removal become Contractor's property.
- 1.10 Scheduling .1 Coordinate work with other activities at site to ensure timely and orderly progress of the Work.

## PART 2 – EXECUTION

- 2.1 Application .1 Do work in compliance with the WMW.  
.2 Implement MSSP for waste generated on Project in compliance with approved methods and as approved by Departmental Representative.  
.3 Materials must be immediately separated into required categories for reuse or recycling.  
.4 Materials in separated condition: collect, handle, store onsite, and transport off-site to an approved and authorized recycling facility.  
.5 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
  - 2.2 Cleaning .1 Remove tools and waste materials on completion of work, and leave work area in clean and orderly condition.  
.2 Cleanup work area as work progresses.  
.3 Source separate materials to be reused/recycled into specified sort areas.
-

- 2.3 Diversion of Materials
- .1 Create a list of materials to be separated from the general waste stream and stockpiled in separate containers, to the approval of the Departmental Representative and consistent with applicable fire regulations.
    - .1 Mark containers.
    - .2 Provide instruction on disposal practices.
  - .2 Onsite sale of salvaged, recovered, reusable, recyclable, etc. materials is not permitted.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Administrative procedures preceding preliminary and final reviews of Work and Final Payment.
- 1.2 Inspection and Declaration .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
- .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
- .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Review: Departmental Representative and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Engineer's Review: Engineer, Departmental Representative, and Contractor will perform review of Work to identify if Work has been completed according to the requirements of the Contract Documents. Contractor shall correct Work accordingly.
- 1.3 Construction Completion Certificate .1 Once the Contractor has completed all Work and correction of deficiencies, he shall submit written certification to the Departmental Representative that
- .1 Contract Documents have been reviewed.
- .2 Work has been completed and inspected for compliance with Contract Documents.
- .3 Defects have been corrected and deficiencies have been completed.
- .4 Work is complete and ready for Final Review.
- .1 Final Review: when items noted above are completed, request final review of Work by Departmental Representative. If Work is deemed incomplete by Departmental representative, complete outstanding items and request another review.
- .2 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Certificate of Substantial Performance.
- 1.4 Close-Out Submittals .1 Project Record Documents as specified in Section 01 33 00.
- .2 As-Built Documents as specified in Section 01 11 00.
-

- .3 Guarantees and Warranties:
- .1 In addition to guarantee requirements contained elsewhere in the Contract Documents to which all Work of this Contract is to be guaranteed for one (1) year after the date of issue of the Construction Completion Certificate by the Departmental Representative.
  - .2 Upon completion of the Work, furnish to the PWGSC a guarantee in writing, stating that the Contractor will make good, at their expense, and to the satisfaction of the Departmental Representative, all defects that may develop in materials and equipment used on the Work for a minimum period of one (1) year from date of Construction Completion Certificate, upon PWGSC assuming custody, that are in the opinion of the Departmental Representative due to the use of improper workmanship and faulty materials and equipment.
  - .3 The Contractor is to, in the case of Work Performed by their Subcontractors and when guarantees are required, secure such guarantees from the Subcontractor and furnish them to PWGSC on or before the final completion of the Work.
  - .4 The guarantees are to provide that all Work furnished and installed by the guarantors are to remain in like new condition and working order for the period of one (1) year and that the guarantors will replace same with new and like materials at no expense to PWGSC unless it can be proven that the defects are caused by abuse and negligence on the part of PGWSC or its employees.
  - .5 It is to be understood that in effecting the replacement, the Contractor or Subcontractor responsible is to also bear all Costs involved in removing or replacing adjacent affected materials.
  - .6 One (1) month prior to expiry of guarantee period, the Departmental Representative will carry out a detailed inspection of the Project.
  - .7 Any defect apparent will be noted and will be forwarded to the Contractor in writing for correction under the terms of the Contract with no additional cost to PWGSC.
- .4 Commencement of Guarantee and Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date of commencement for warranty periods.
-

## 1.5 Final Payment

- .1 Final Payment: When Departmental Representative considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request final review.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Section Includes
- .1 Removal and/or demolition of culverts.
  - .2 Removal of structures.
  - .3 Abandonment and/or removal of piping.
- 1.2 Payment Procedure
- .1 The unit prices bid for this item shall be full compensation for the removal, demolition and abandonment of all items identified on the Drawings and as directed by the Departmental Representative.
  - .2 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities. Backfill and reinstatement to be considered incidental in the payment item.
- 1.3 References
- .1 Canadian Standards Association (CSA International).
    - .1 CSA S350-M1980(R1998), Code of Practice for Safety in Demolition of Structures.
    - .2 Canadian Environmental Assessment Act (CEAA)
    - .3 Canadian Environmental Protection Act (CEPA)
      - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
    - .4 Transportation of Dangerous Goods Act (TDGA)
  - .2 Comply with National Building code of Canada, Part 8, "Safety Measures at Construction and Demolition Sites", and Provincial requirements.
- 1.4 Storage and Protection
- .1 Perform all work in accordance with Section 01 35 43 – Environmental Protection.
  - .2 Protect in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling, and Section 31 24 13 – Roadway Excavation Embankment and Compaction.
  - .3 Protect existing items designated to remain. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to the Contract.
  - .4 In all circumstances, ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
  - .5 Do not dispose of waste of volatile materials such as, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses. Ensure disposal procedures are in accordance with the Waste Management Workplan and to the satisfaction of the
-

- Departmental Representative.
- .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
  - .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities, and the EASR.
  - .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
- 1.5 Regulatory Requirements .1 Ensure all work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable provincial regulations.

## PART 2 - PRODUCTS

- 2.1 Equipment .1 Equipment and heavy machinery used to meet or exceed all applicable emission requirements.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

## PART 3 - EXECUTION

- 3.1 Preparation .1 Review site with Departmental Representative and verify extent and location of items designated for removal, disposal, abandonment and items to remain.
- 3.2 Sequences of Operation .1 Removal:
  - .1 Remove items as indicated.
  - .2 Do not disturb items designated to remain in place.
- .2 Backfill:
  - .1 Backfill in areas as indicated and in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling.
- 3.3 Restoration .1 Restore areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.
- .2 Use only soil treatments and procedures that are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.
-

## 3.4 Cleanup

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean, neat and tidy.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment .1 All materials, labour, equipment, and services necessary for any toxic waste removal of existing materials shall be paid as a Change Order to this Contract.
- 1.2 References .1 Canadian Environmental Protection Act, CEPA.  
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).  
.1 Material Safety Data Sheets (MSDS)  
.3 National Fire Code of Canada latest edition.  
.4 Transportation of Dangerous Goods Act (TDG Act).  
.5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).
- 1.3 Definitions .1 Toxic: For the purposes of this specification, a substance is considered toxic if it is listed on the Toxic Substances List found in Schedule 1 of CEPA.  
.2 List of Toxic Substances: found in Schedule 1 of CEPA, lists all substances that have been assessed as toxic. The federal government can make regulations with respect to a substance specified on the List of Toxic Substances. Column II of this List identifies the type of regulation applicable to each substance.
- 1.4 Submittals .1 Product Data:  
.1 Submit photocopies of shipping documents and waste manifests to Departmental Representative when shipping toxic wastes off-site.  
.2 Maintain 1 copy of product data in a readily accessible file onsite.  
.2 Submission Requirements:  
.1 Submit product data to Departmental Representative in accordance with Section 01 33 00, Submittal Procedures.  
.2 Express all weights and volumes in SI Metric units.  
.3 Accompany submissions with a transmittal letter containing:  
.1 Date.  
.2 Project title and number.  
.3 Contractor's name and address.  
.4 Identification and quantity of attached product data.  
.5 Other pertinent data.
-

- 1.5 Storage and Handling
- .1 Store and handle toxic wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
  - .2 Store and handle flammable and combustible wastes in accordance with current National Fire Code of Canada requirements.
  - .3 Coordinate storage of toxic wastes with Departmental Representative and abide by internal requirements for labeling and storage of wastes.
  - .4 Observe smoking regulations at all times. Smoking is prohibited in any area where toxic wastes are stored, used, or handled.
  - .5 Report spills or accidents involving toxic wastes immediately to Departmental Representative and to appropriate regulatory authorities within 24 hours of incident. Take all reasonable measures to contain the release while ensuring health and safety is protected.
  - .6 Transport toxic wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
  - .7 Use only an authorized/licensed carrier to transport toxic waste.
  - .8 Coordinate transportation and disposal of toxic wastes with Departmental Representative.
- 1.6 Waste Management and Disposal
- .1 Dispose of toxic wastes generated onsite in accordance with applicable federal and provincial acts, regulations, and guidelines.
  - .2 Ensure toxic waste is shipped to an authorized/licensed treatment or disposal facility and that all liability insurance requirements are met.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 References
- .1 Canadian Environmental Protection Act, CEPA.
    - .1 Export and Import of Hazardous Waste Regulations (EIHW Regulations), SOR/2002-200.
    - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
      - .1 Material Safety Data Sheets (MSDS)
    - .3 National Fire Code of Canada.
    - .4 Transportation of Dangerous Goods Act (TDG Act) 1999, (c.34).
    - .5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).
- 1.2 Definitions
- .1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets the hazard criteria established in Transportation of Dangerous Goods Regulations.
  - .2 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.
  - .3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment, or disposal.
- 1.3 Submittals
- .1 Submit product data in accordance with Section 01 33 00, Submittal Procedures.
  - .2 Submit to Departmental Representative current MSDSs for each hazardous material required prior to bringing it/them onsite.
  - .3 Submit a hazardous materials management plan to Departmental Representative that identifies all hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.
- 1.4 Storage and Handling
- .1 Coordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labeling and storage of materials and wastes.
  - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
  - .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
-

- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene, and naphtha for ready use. Store all flammable and combustible liquids in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
  - .5 Transfer of flammable and combustible liquids will not be carried out in the vicinity of open flames or any type of heat-producing devices.
  - .6 Flammable liquids having a flash point below 38 degrees Celsius, such as naphtha or gasoline will not be used as solvents or cleaning agents.
  - .7 Store flammable and combustible waste liquids for disposal in approved containers located in a safe, ventilated area. Keep quantities to an absolute minimum.
  - .8 Observe smoking regulations at all times. Smoking is prohibited in any area where hazardous materials are stored, used, or handled.
  - .9 Abide by the following storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids and 5 litres for liquids:
    - .1 Store hazardous materials and wastes in closed and sealed containers which are in good condition.
    - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
    - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
    - .4 Segregate incompatible materials and wastes.
    - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
    - .6 Store hazardous materials and wastes in a secure storage area with controlled access.
    - .7 Maintain a clear egress from storage area.
    - .8 Store hazardous materials and wastes in a manner and location which will prevent them from spilling into the environment.
    - .9 Have appropriate emergency spill response equipment available near the storage area, including personal protective equipment.
    - .10 Maintain an inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
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- .11 Ensure personnel have been trained in accordance with WHMIS requirements.
  - .12 Report spills or accidents involving toxic wastes immediately to Departmental Representative and to appropriate regulatory authorities within 24 hours of incident. Take all reasonable measures to contain the release while ensuring health and safety is protected.
- 1.5 Transportation
- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
  - .2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.
  - .3 If hazardous waste is generated onsite:
    - .1 Coordinate transportation and disposal with Departmental Representative.
    - .2 Ensure compliance with applicable federal, provincial, and municipal laws and regulations for generators of hazardous waste.
    - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
    - .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
    - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
    - .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
    - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
    - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.
    - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
-



**PART 2 - PRODUCTS**

- 2.1 Materials
- .1 Only bring onsite the quantity of hazardous materials required to perform Work.
  - .2 Maintain MSDSs in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

**PART 3 – EXECUTION**

- 3.1 Disposal
- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
  - .2 Recycle hazardous wastes for which there is an approved, cost-effective recycling process available.
  - .3 Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities.
  - .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
  - .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, the environment in general, or in municipal solid waste landfills is prohibited.
  - .6 Dispose of hazardous wastes in a timely fashion in accordance with applicable provincial regulations.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurements for Payment .1 Payment for precast concrete no-post barrier:
- .1 Shall be full compensation for all work necessary and incidental for supply and installation of all concrete precast units of types and sizes indicated to lines, grades and cross section in accordance with the Drawings and as directed by the Departmental Representative.
  - .2 Measurement for payment for this item shall be at the unit price for each lineal metre of barrier installed, as measured and accepted by the Departmental Representative
- .2 Payment for precast concrete pipe headwalls shall be included in the lump sum unit price tendered for the individual culvert at the locations indicated on the Contract Drawings.
- .3 Payment for concrete pull boxes shall be included in the lump sum unit price tendered for the fiber optic communications at the locations indicated on the Contract Drawings
- 1.2 References .1 Canadian Standards Association (CSA International)
- .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- 1.3 Design Requirements .1 Design precast elements within a travelled surface to be designed to carry H20 traffic loads as specified and in accordance with applicable codes.
- 1.4 Submittals .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

**PART 2 - PRODUCTS**

- 2.1 Materials .1 Precast concrete units to be constructed in accordance with CAN/CSA-A23.1 unless otherwise stated.
-

**PART 3 -EXECUTION**

- 3.1 General
- .1 Install precast concrete units, including surface tolerances, finishing and field quality control, in accordance with the Contract Documents.
  - .2 Protection, storage and handling of precast concrete units to Manufacturer's recommendations.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Related Sections
- .1 Excavation, Trenching and Backfilling to Section 31 23 33
  - .2 Aggregates to Section 31 05 16
  - .3 Horizontal Directional Drilling to Section 33 34 01
- 1.2 Measurement for Payment
- .1 The unit price bid for this item shall be full compensation for all work necessary and incidental for the supply, installation, testing and commissioning of the fiber optic communications, as indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The bid price shall include but not be limited to: supply and installation of underground conduits, pull boxes including excavation, trenching, bedding, backfill and compaction and/or directional drilling; supply, install and test fiber optic cables; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities
- 1.3 Permits, Fees and Inspection
- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
  - .2 Pay associated fees.
  - .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
  - .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
  - .5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative
- 1.4 Submittals
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit manufacturers' literature for fiber optic cable and termination systems, indicating compliance with specifications.
  - .3 Contractor shall submit shop drawings in electronic format for the Departmental Representative's review.
  - .4 Shop drawings means technical data specifically prepared for the work of this Contract including: drawings, diagrams, data sheets, templates, spec sheets, schedules, calculations, instructions, and similar information not printed in standard form.
-

- .5 Present shop drawings in clear and thorough manner to appropriately illustrate the work. Shop drawings are required for all equipment and accessories to be installed as part of this work.
  - .6 Identify field dimensions on the drawings.
  - .7 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable catalogue and brochure material. Do not assume catalogues are available in the Department Representative's office. Maintenance manuals and operating manuals are not suitable submittal material.
  - .8 Clearly mark materials with arrows, circles, clouds and underline marks. Cross-out non-applicable sections.
  - .9 Include technical data such as dimensions, performance with sufficient detail to allow the Engineer to verify the suitability of the material or equipment.
  - .10 Installed materials shall meet the requirements of the shop drawings irrespective of whether or not the Departmental has reviewed the shop drawings.
  - .11 Do not order materials or equipment until the engineer has reviewed and returned the shop drawings.
  - .12 Departmental Representative's review of shop drawings does not alleviate the Contractor for errors or omissions, nor deviations from the Contract documents.
- 1.5 Delivery and Storage
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Store materials off ground and in accordance with manufacturer's recommendations.
  - .4 All equipment shall be adequately protected from damage and from dust, dampness or any other injurious substance during delivery to the site, while stored at the site and after construction.
  - .5 Equipment stored in unheated or open areas on the site shall be covered and provided with thermostatically controlled heaters of sufficient size to keep the temperature of the equipment above the dew point.
  - .6 Electrical equipment shall not be installed until the room in which they are to be installed is completely free of any dust, dirt, dampness, construction debris or any other contaminants that might affect the future operation of the electrical equipment.
  - .7 Replace defective or damaged materials with new.
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- 1.6 Waste Management and Disposal .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- 1.7 Field Quality Control .1 Carry out tests in presence of Departmental Representative.
- .2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .3 Submit test results for Departmental Representative's review.
- 1.8 Closeout Submittals .1 Provide record drawings, including lists of equipment and maintenance and operating manuals in accordance with Section 01 77 00 - Closeout Submittals.
- .1 Include three complete bound sets of typewritten or printed instructions, covering the proper method of maintaining and operating all the communication systems included in this Contract.
- .2 Manuals shall also include all shop drawings, catalogue numbers of all electrical equipment installed and manufacturer's parts lists, manufacturer's O&M manuals, drawings and installation leaflets for all equipment.

## PART 2 – PRODUCTS

- 2.1 Material and Equipment .1 Supply equipment as indicated by the drawings and specifications. Other materials may be substituted by the Contractor provided that such substitutions have been approved by the Departmental Representative prior to installation.
- .2 All equipment and materials shall be new and shall bear a certification mark (CSA, ULc, ETL, etc.) that is acceptable to the BC Safety Authority.
- .3 Factory-assemble control panels and component assemblies. Finished control panels and component assemblies shall bear a certification mark (CSA, ULc, ETL, etc.) that is acceptable to the BC Safety Authority.
- .4 Shop drawings shall be submitted for major electrical items.
- .5 When submitting shop drawings, the Contractor shall notify the Departmental Representative in writing of changes made therein from the electrical drawings and specifications.
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- 2.2 Equipment Identification
1. Identify electrical equipment with nameplates as follows: Lamacoid 3mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws.
  - .2 Identification to be English.
- 2.3 Wiring Identification
1. Use colour coded wires in communication cables, matched throughout system.
- 2.4 Manufacturer's and CSA Labels
1. Visible and legible after equipment is installed.
- 2.5 Warning Signs
1. As specified and to meet requirements of Electrical Inspection Department and Department Representative.
  - .2 Decal signs, minimum size 175 x 250 mm.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Related Sections .1 Section 27 05 26 - Grounding and Bonding for Communications Systems.
- .2 Section 27 11 19 - Communication Terminal Blocks and Patch Panels.
- 1.2 Measurement for Payment .1 No measurement for payment will be made under this Section.
- 1.3 References .1 EIA-TIA Fiber Optic Standards including ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard and ANSI/TIA/EIA-590-A, Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant.
- .2 IEC Standards International.
- .3 The Fiber Optic Association, Inc.
- .4 BICSI Reference Standards for Outside Plant Installations.
- 1.4 Submittals .1 Submittals in accordance with Section 27 05 01 – Common Work Results - Communications.
- 1.5 Certification .1 Fiber optic cable shall be tested, certified and labeled for conformance with CAN/CSA-ISO/IEC Standards, EIA-445 Fiber Optic Test Procedures (FOTPs) (These are commonly known as "FOTPs" but are officially called "EIA-455-x, e.g. EIA-455-34 is FOTP-34) and in accordance with, ULC, or other certification program accredited by Standards Council of Canada.
- 1.6 Delivery, Storage and Handling .1 Store to protect materials from wind, moisture, sunlight and accidental ignition.
- .2 Install fiber optic cable during dry weather conditions.
- 1.7 Waste Management and Disposal .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

**PART 2 - PRODUCTS**

- 2.1 Materials .1 Fiber Optic Cable
- .1 Loose tube, gel filled, single mode fiber optic cable. Fiber counts as defined on the associated drawings.
- .2 Install 8.3/125 micron single-mode fiber optic cable to support data communication services.
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- .3 Outside plant cable shall be used for all applications where cable is to be run in underground conduits. Outside plant cable may not be used for interior applications and shall meet the following specifications:
  - .1 Gel filled buffer tube, 250 um, acrylate.
  - .2 EIA/TIA-598 color coding for fiber optic cable.
  - .3 Flooded core
  - .4 Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
  - .5 Capable of a minimum crush resistance of 850 lb./in.
- .4 Installed fiber must meet or exceed the following performance specifications:

Fiber cable types	Wavelength (nm)	Max. Attn. (dB/Km)
Single-mode,	1,310	0.35
Outside plant	1,550	0.2

### PART 3 - EXECUTION

- 3.1 Pre-Install Checklist
    - .1 Main point of contact/project manager selected.
    - .2 All permits available for inspection.
    - .3 Sites prepared.
    - .4 All components on site, inspected, security arranged if necessary.
    - .5 Relevant personnel notified.
    - .6 Safety rules posted on the job site(s) and reviewed with all supervisors and installation personnel.
  - 3.2 Receiving Fiber Optic Cabling and Equipment Onsite
    - .1 Fiber Optic equipment and components are subject to damage by improper handling and must be handled accordingly.
    - .2 When initially received on the job site all fiber optic components should be carefully inspected for damage and tested for continuity or loss if damage is suspected.
    - .3 Ensure that all components and parts have been shipped, received, match quantities ordered (e.g. fiber optic cable contains the number and type of fiber ordered and is the length ordered), and that any discrepancies or damaged goods are noted, the supplier notified and replaced as required.
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- .4 All equipment and cabling shall be stored in a clean and dry location, protected from harsh environments and extremes of cold and heat.
  - 3.3 Handling Fiber Optic Cables Onsite
    - .1 Handle reels of fiber optic cable with care. All reels, regardless of size or length, must have both ends of the cable available for the testing. A fiber tracer or visual fault locator and bare fiber adapters both ends of the cable available for the testing. A fiber tracer or visual fault locator and bare fiber adapters can be used for continuity testing.
    - .2 Move small, lightweight spools of fiber optic cable by hand. Move larger reels with appropriate lifting equipment or using two or more installers skilled in the moving operation.
    - .3 Lifting equipment shall only must reels with a matched set of slings or chokers, attached to an appropriately sized piece of pipe inserted into the hole in the center of the reel. Slings and chokers shall never be attached around the spooled area of the reel. The cable reels shall be moved carefully to avoid damage to the cable.
  - 3.4 Fire Stopping
    - .1 All telecommunications fire stopping shall comply with applicable codes and standards, including TIA/EIA 569-A-Annex A and NECA/BICSI 568-2001.
    - .2 All penetrations shall be protected by approved firestops. Fire stopping compounds and devices shall be used whenever a fire separation has been breached by an installation.
    - .3 In most geographical locals the breaching of a fire separation will require physical monitoring until it has been repaired.
    - .4 Check with the "Authority Having Jurisdiction" for specific requirements on the project before commencing work.
  - 3.5 Pulling Cable
    - .1 All fiber cable is to be protected within conduit. After installation, conduits are to be permanently labeled as containing fiber optic cable.
    - .2 All cable and conduit are to be fully supported throughout its entire run.
    - .3 At no time shall more than 400 pounds of tension be placed on any fiber cable while it is being pulled through tray or conduit. It is preferred that all fiber cable be pulled with hand power only. If power winches or mechanical advantage devices are used to pull cable, a tensionometer must be used to insure that maximum tension is not exceeded. Alternatively, a "mechanical fuse" rated at 350 pounds may be included in the linkage. Torsion shall be avoided by the use of a swivel at the cable end. While under tension, a minimum bend radius of 20 times the outside cable diameter will be maintained through the use of pulleys and sheaves where required. After pulling, no bend may have a radius, at rest, of less than 10 times the outside cable diameter.
  - 3.6 Labeling
    - .1 Each cable and inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the
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- cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of “Service Vault Splice Case number—cable number”.
- .2 Each fiber optic strand shall be labeled with a unique identifier at the splice case in the junction box and at the Fiber Patch Panels. Connectors shall be labeled on the identifying sheets on the front of the splice case.
  - .3 Each fiber shall be labeled where it enters the back of the coupler panels. The identifier shall be in the format Cable # - tube- strand.
- 3.7 Testing
- .1 It is suggested that each individual fiber in a cable be tested with an OTDR for length and transmission anomalies while on the reel before installation.
  - .2 All single mode fiber strands shall be tested end-to-end for bi-directional attenuation: 1310 nm/1550 nm for single-mode fibers. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer’s instructions for the test set being utilized.
  - .3 Tests must ensure that the measured link loss for each strand does not exceed the “worst case” allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above, 2.1.1 and 2.2.1).
  - .4 After the cable is in place it shall be tested in the following manner:
    - .1 After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to CNS in the form of hard-copy printouts or photographs of screen traces.
    - .2 After termination and bulkhead mounting, each terminated fiber is to be tested for end-to-end loss with a power meter/light source. As above, results are to be recorded and supplied to CNS.
    - .3 The maximum allowable attenuation for any splice or termination is 0.3 dB.
  - .5 The contractor shall review all end faces of field terminated connectors with a fiber inspection scope following the final polish. Connector end faces with hackles, scratches, cracks, chips and or surface pitting shall be rejected and repolished or replaced if repolishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 200X for single-mode fiber.
  - .6 Any deviation from these test procedures must be approved in writing in advance by PWGSC.
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- 3.8 Report
- .1 Record results in tabular form.
  - .2 Segregate runs by service vault location and by type of cable.
  - .3 Report Submission:
    - .1 Submit three 3 reports printed on 215 mm x 280 mm white paper. Provide one copy with cerlox binding for systems administrator. Leave remaining copies unbound for insertion into O&M manuals.
    - .2 Submit report prepared in electronic form (spreadsheet).

**END OF SECTION**

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**PART 1 - GENERAL**

- |                                   |    |  |
|-----------------------------------|----|--|
| 1.1 Related Sections              | .1 | Section 27 05 13 –Communication Services.  |
|                                   | .2 | Section 27 11 19 - Communication Terminal Blocks and Patch Panels.   |
| 1.2 Basis of Payment              | .1 | No measurement for payment will be made under this Section.  |
| 1.3 References                    | .1 | EIA-TIA Fiber Optic Standards including ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard and ANSI/TIA/EIA-590-A, Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant. |
|                                   | .2 | IEC Standards International.   |
|                                   | .3 | The Fiber Optic Association, Inc.  |
|                                   | .4 | BICSI Reference Standards for Outside Plant Installations.   |
| 1.4 Submittals                    | .1 | Submittals in accordance with Section 27 05 01 – Common Work Results - Communications.   |
| 1.5 Delivery and Storage Handling | .1 | Store to protect materials from wind, moisture, sunlight and accidental ignition.  |
|                                   | .2 | Install fiber optic cable during dry weather conditions.   |
| 1.6 Waste Management and Disposal | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.  |
|                                   | .2 | Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.   |

**PART 2 - PRODUCTS**

- |               |    |  |
|---------------|----|--|
| 2.1 Materials | .1 | Stranded #6, AWG TWH, Green copper ground conductors. Single point ground system.  |
|               | .2 | Two-hole short-barrel single crimp lugs (T&B preferred), no-oxide paste, hex-head steel bolts and nuts, flat washers and lock washers. Splices to be avoided but “C” type compression connectors should be used. Do not use electric arc weld, solder joints or split bolt connectors. |
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**PART 3 - EXECUTION**

- 3.1 Pre-Install Checklist
- .1 Main point of contact/project manager selected.
  - .2 All permits available for inspection.
  - .3 Sites prepared.
  - .4 All components on site, inspected, security arranged if necessary.
  - .5 Relevant personnel notified.
  - .6 Safety rules posted on the job site(s) and reviewed with all supervisors and installation personnel.
- 3.2 Firestopping
- .1 All telecommunications fire stopping shall comply with applicable codes and standards, including TIA/EIA 569-A-Annex A and NECA/BICSI 568-2001.
  - .2 All penetrations shall be protected by approved firestops. Fire stopping compounds and devices shall be used whenever a fire separation has been breached by an installation.
  - .3 In most geographical locals the breaching of a fire separation will require physical monitoring until it has been repaired.
  - .4 Check with the “Authority Having Jurisdiction” for specific requirements on the project before commencing work.
- 3.3 Grounding and Bonding
- .1 Ground systems shall be designed as specified by the Canadian Electrical Safety Code (latest edition) and other applicable codes and standards (ANSI/TIA/EIA 607-A, NECA-BICSI-568-2001).
  - .2 Although most fiber optic cables are not conductive, any metallic hardware used in fiber optic cabling systems (such as wall-mounted termination boxes, racks, and patch panels) must be grounded.
  - .3 Conductive cables require proper grounding and bonding for applicable conductors.
  - .4 Ground conductors must be routed in a manner to minimize sharp bends. The objective minimum ground wire turning radius for leads up to #6AWG is 150 mm.
  - .5 All connections should be tight. However, do not over tighten to the point where threads are stripped. Follow manufacturers recommended torquing specifications.
  - .6 The point of connection to equipment and racks will be scraped to bare metal and have a coating of no-oxide paste applied. The point of connection may be at the top or bottom of the rack, depending on the routing of the ground cable. One connection is required to welded racks and a connection to each upright is required for bolted racks.
-

- .7 Non-metallic conduit is required if conduit is needed to protect the grounding cable.
- .8 The metallic members of optical fibre cables entering buildings shall be grounded and have 75mm insulation gap as close to the point of entrance as practical.

**END OF SECTION**

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**PART 1 - GENERAL**

- |                                    |    |  |
|------------------------------------|----|--|
| 1.1 Related Sections               | .1 | Section 27 05 13 – Communication Services  |
|                                    | .2 | Section 27 05 26 – Grounding and Bonding for Communications Systems  |
| 1.2 Basis of Payment               | .1 | No measurement for payment will be made under this Section.  |
| 1.3 References                     | .1 | EIA-TIA Fiber Optic Standards including ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard and ANSI/TIA/EIA-590-A, Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant.   |
|                                    | .2 | IEC Standards International.   |
|                                    | .3 | The Fiber Optic Association, Inc.  |
|                                    | .4 | BICSI Reference Standards for Outside Plant Installations.   |
| 1.4 Submittals                     | .1 | Submittals in accordance with Section 27 05 01 – Common Work Results - Communications.   |
| 1.5 Certification                  | .1 | Fiber optic cable shall be tested, certified and labeled for conformance with CAN/CSA-ISO/IEC Standards, EIA-445 Fiber Optic Test Procedures (FOTPs) (These are commonly known as "FOTPs" but are officially called "EIA-455-x, e.g. EIA-455-34 is FOTP-34) and in accordance with, ULC, or other certification program accredited by Standards Council of Canada. |
| 1.5 Delivery, Storage and Handling | .1 | Store to protect materials from wind, moisture, sunlight and accidental ignition.  |
|                                    | .2 | Install fiber optic cable during dry weather conditions.   |
| 1.6 Waste Management and Disposal  | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.  |
|                                    | .2 | Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.   |
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**PART 2 - PRODUCTS**

- 2.1 Materials
- .1 The terminal ends of all fibers cable strands shall be field connectorized with SC connectors. The connectors shall be mounted on bulkheads and installed in enclosures Termination of cables may be of several types including mechanical or fusion spliced pigtails. The choice of termination method must be cleared with the Department Representative prior to termination.
  - .2 Fiber cables are to be terminated in one of two types of enclosures. These may be either wall-mounted or rack-mountable stand-alone units for installation. The final choice of fiber organizer shall be cleared with the Owner Representative prior to installation.
  - .3 Enclosures shall facilitate sorting and organization of optical fiber splices between outside plant and indoor riser cables routed to cross connection equipment. Enclosures shall have various mounting options, be dust proof, water resistant, and constructed of aluminum, with a durable power-coating. Gasketed door shall offer maximum access to enclosure interior during installation and service, and have a lockable option for added security. Enclosures shall facilitate cable pass through to adjacent units. Enclosures shall be locking or cable of having locks installed.

**PART 3 - EXECUTION**

- 3.1 Pre-Install Checklist
- .1 Main point of contact/project manager selected.
  - .2 All permits available for inspection.
  - .3 Sites prepared.
  - .4 All components on site, inspected, security arranged if necessary.
  - .5 Relevant personnel notified.
  - .6 Safety rules posted on the job site(s) and reviewed with all supervisors and installation personnel.
- 3.2 Labelling
- .1 Each cable and inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of "Service Vault Splice Case number—cable number".
  - .2 Each fiber optic strand shall be labeled with a unique identifier at the splice case in the junction box and at the Fiber Patch Panels. Connectors shall be labeled on the identifying sheets on the front of the splice case.
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- .3 Each fiber shall be labeled where it enters the back of the coupler panels. The identifier shall be in the format Cable # - tube- strand.
- 3.3 Termination Standards
- .1 The terminal ends of all fibers cable strands shall be field connectorized with SC connectors. The connectors shall be mounted on bulkheads and installed in enclosures Termination of cables may be of several types including mechanical or fusion spliced pigtails. The choice of termination method must be cleared with the Owner Representative prior to termination.
  - .2 Fiber cables are to be terminated in one of two types of enclosures. These may be either wall-mounted or rack-mountable stand-alone units for installation. The final choice of fiber organizer shall be cleared with the Owner Representative prior to installation.
  - .3 Each enclosure shall be labeled with a machine made label with permanent black ink on a white background. Labels shall be in the format "SVSC\_NNNNN", with the letters, "NN", supplied on the drawings. In addition, each SVSC shall be labeled on the face plate with the identifiers of the cables it contains.
  - .4 At each end of the cable, sufficient slack (40 meters for pull boxes and 10 meters for fiber patch panels) shall be left to facilitate reasonable future relocation. Slack shall be mounted on walls or upper ladder racks according to the Owner Representative's direction.
- 3.4 Testing
- .1 It is suggested that each individual fiber in a cable be tested with an OTDR for length and transmission anomalies while on the reel before installation.
  - .2 All single mode and multi-mode fiber strands shall be tested end-to-end for bi-directional attenuation, 850 nm/1300 nm for multimode and 1310 nm/1550 nm for single mode fibers. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer's instructions for the test set being utilized.
  - .3 Tests must ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above, 2.1.1 and 2.2.1).
  - .4 After the cable is in place it shall be tested in the following manner:
    - .1 After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to CNS in the form of hard-copy printouts or photographs of screen traces.
    - .2 After termination and bulkhead mounting, each terminated fiber is to be tested for end-to-end loss with a power
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meter/light source. As above, results are to be recorded and supplied to CNS.

.3 The maximum allowable attenuation for any splice or termination is 0.3 dB.

.5 The contractor shall review all end faces of field terminated connectors with a fiber inspection scope following the final polish. Connector end faces with hackles, scratches, cracks, chips and or surface pitting shall be rejected and re-polished or replaced if re-polishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 200X for single mode fiber.

.6 Any deviation from these test procedures must be approved in writing in advance by the Department Representative.

### 3.5 Report

.1 Record results in tabular form.

.2 Segregate runs by service vault location and by type of cable.

.3 Report Submission:

.1 Submit three 3 reports printed on 215 mm x 280 mm white paper. Provide one copy with cerlox binding for systems administrator. Leave remaining copies unbound for insertion into O&M manuals.

.2 Submit report prepared in electronic form using Microsoft Excel.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Basis of Payment .1 No measurement for payment will be made under this Section.
- 1.2 References .1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- 1.3 Samples .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
  - .2 Allow sampling by third-party tester during production.
  - .3 Provide third-party tester with access to source and processed material for sampling if requested by Departmental Representative.
  - .4 Install sampling facilities at discharge end of production conveyor, to allow third party tester to obtain representative samples of items being produced. Stop conveyor belt when directed by third-party tester to permit full cross section sampling.
  - .5 Do not stockpile material so as to interfere with site operation and drainage.

**PART 2 - PRODUCTS**

- 2.1 Materials - General .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
    - .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
      - .1 Greater dimension to exceed 5 times least dimension.
    - .3 Fine aggregates satisfying requirements of applicable section to be one or blend of following:
      - .1 Natural sand.
      - .2 Manufactured sand.
      - .3 Screenings produced in crushing of quarried rock, boulders, or gravel.
    - .4 Coarse aggregates satisfying requirements of applicable section to be one or blend of following:
      - .1 Crushed rock.
      - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
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- .5 All crushed gravel when tested to ASTM C136 and ASTM C117 to conform to the following:
- .2 Liquid limit: maximum 25.
  - .3 Plasticity index: maximum 6.
  - .4 Crushed particles: at least 20% of particles by mass retained on 4.75 mm sieve to have at least one freshly fractured face.

**2.2 Granular Pipe Bedding and Surround**

- .1 Crushed stone or graded gravels to conform to the following gradations:

<b>Sieve Designation</b>	<b>% Passing</b>
25 mm	100
19 mm	90 – 100
12.5 mm	65 – 85
9.5 mm	50 – 70
4.75 mm	25 – 50
2.36 mm	10 – 35
1.18 mm	6 – 26
0.600 mm	3 – 17
0.075 mm	0 – 5

**2.3 Drain Rock**

- .1 Clean round stone or crushed stone to conform to the following gradations:

<b>Sieve Designation</b>	<b>% Passing</b>
25 mm	100
19 mm	0 – 100
9.5 mm	0 – 5
4.75 mm	0

Drain rock to be used only where specified. Use of drain rock other than as specified requires approval from the Departmental Representative.

**2.4 Pit Run Gravel**

- .1 Well graded granular material free from clay lumps, organic material and other extraneous material.

<b>Sieve Designation</b>	<b>% Passing</b>
75 mm	100
50 mm	70 - 100
25 mm	50 - 100
4.75 mm	22 - 100
2.36 mm	10 - 85
0.075 mm	2 - 8

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2.5 Crushed Course Aggregate .1 Clear crushed stone to conform to the following gradations:

<b>Sieve Designation</b>	<b>% Passing</b>
50 mm	100
38 mm	75 – 100
25 mm	40 – 70
19 mm	12 - 42
12.5 mm	4 - 15
9.5 mm	0 - 9

2.6 Bulk Rock Fill .1 Free draining, well-graded 200 mm minus blast rock.

- 2.7 Source Quality Control .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 2 weeks prior to commencing production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative 2 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

### PART 3 – EXECUTION

- 3.1 Processing .1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.
- .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified.
- .3 Wash aggregates, if required to meet specifications.

3.2 Handling .1 Avoid segregation, contamination, and degradation of aggregate during handling and transporting.

- 3.3 Stockpiling .1 Stockpile aggregates in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpile sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling
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equipment.

- .4 Provide compacted sand or crushed gravel base not less than 300 mm in depth to prevent contamination of aggregate. Do not incorporate compacted base of pile into work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials.
- .7 Stockpile aggregates in uniform layers of thickness as follows:
  - .1 Max 1.5 m for coarse aggregate and base course materials.
  - .2 Max 1.5 m for fine aggregate and sub-base materials.
  - .3 Max 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

#### 3.4 Cleaning

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for grubbing to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: excavating and disposing stumps and roots to 150 mm below existing ground surface, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities.
- 1.2 Definitions
- .1 Clearing: Cutting of trees, brushing vegetative growth to ground level and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
  - .2 Grubbing: Excavating and disposing stumps and roots to 150 mm below existing ground surface.
  - .3 Chipping: Mechanically breaking down of all vegetation up to 120 mm in diameter into chips not over 100 mm long, 25 mm wide and 10 mm thick.
  - .4 License to Cut: License required by Contractor under Province of British Columbia's Forest Act that authorizes a Contractor to salvage and remove timber from Crown Land.
  - .5 Merchantable Timber: Timber greater than 120 mm diameter at breast height and suitable for salvage. This material is the property of the Contractor.
  - .6 Stumpage: Payment by Contractor to Province of British Columbia for timber harvested under License to Cut. Stumpage is required as condition of License to Cut by Province of British Columbia's Forest Act.
- 1.3 Storage and Protection
- .1 Prevent damage to trees, bench marks, existing chip seal, site appurtenances, watercourses, root systems of trees, all natural features and artificial structures that are to remain.
  - .2 Repair any damaged items to satisfaction of Departmental Representative.
  - .3 Protect nesting birds in accordance with Section 01 35 43 – Environmental Protection.
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**PART 2 - PRODUCTS**

2.1 Not Used .1 Not Used.

**PART 3 – EXECUTION**

3.1 Preparation .1 Inspect site and verify with Departmental Representative, items designated to remain.

.2 Contractor to provide License to Cut.

3.2 Clearing .1 Clear, in accordance with Contract Documents, by cutting flush with ground, except in areas where hand clearing is required. Cut hand cleared areas to within 150 mm of ground.

.2 Cut off branches and cut down trees overhanging cleared area as required for safety and in accordance with the Contract Documents.

.3 Clearing works have been undertaken by separate Contract.

3.3 Grubbing .1 Grub out stumps, roots, and embedded logs to not less than 150 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.

3.4 Removal and Disposal .1 Cut timber greater than 125 mm diameter to 3.0 m lengths and cold-deck as required by British Columbia Ministry of Forests. Stockpiled timber becomes property of Contractor.

.2 Dispose of cleared and grubbed materials off site.

3.5 Burning .1 Is not allowed.

3.6 Salvage of Timber .1 Salvage timber:

.1 Salvage timber according to License to Cut.

.2 Remove salvaged timber from site.

.3 Salvaged timber becomes property of the Contractor.

.4 Pay stumpage fees associated with salvage of timber and provide Departmental Representative with proof that stumpage has been paid.

3.7 Finished Surface .1 Leave ground surface in condition suitable for stripping of topsoil.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Measurement for Payment .1 No separate payment will be made for excavating, trenching and backfilling. These items shall be included in all work as part of total contract amount.
- 1.2 References .1 American Society for Testing and Materials (ASTM):
- .1 ASTM C 117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D 698-00a1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ) (600 kN-m/m ).
  - .5 ASTM D 1557-02e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ) (2,700 kN-m/m ).
  - .6 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA):
- .1 CAN/CSA-A3000, Portland Cement.
  - .2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- 1.3 Definitions .1 Excavation classes: two classes of excavation will be recognized: common excavation and rock excavation.
- .1 Rock: material from solid masses of igneous, sedimentary or metamorphic rock that, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass. Boulder or rock fragments measuring in volume one cubic metre or more.
  - .2 Common excavation: excavation of materials of whatever nature, that are not included under definitions of rock excavation.
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- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
  - .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
  - .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
  - .5 Unsuitable materials:
    - .1 Weak and compressible materials under excavated areas.
    - .2 Frost susceptible materials under excavated areas.
    - .3 Frost susceptible materials:
      - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.2.
      - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 – 80
0.005 mm	0 – 45
      - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
  - .6 Unshrinkable fill:
    - .1 Very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- 1.4 Quality Assurance
- .1 Engage services of qualified Professional Engineer who is registered or licensed in Province of British Columbia, Canada in which Work is to be carried out to design and inspect shoring and bracing required for Work if required by applicable legislation.
  - .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
  - .3 At least 2 weeks prior to performing Excavation, Trenching, or Backfilling Work, Contractor to provide Departmental Representative with a Construction Sequence for the Work. Do not proceed with the Work until approval has been received from the Departmental Representative.
-

- 1.5 Waste Management and Disposal .1 Dispose of waste materials in accordance with Section 01 74 21 - Waste Management and Disposal and the Waste Management Workplan.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Ensure emptied containers are sealed and stored safely.
- 1.6 Protection of Existing Features .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Existing surface features:
- .1 Conduct, with Departmental Representative, condition survey of existing trees and other plants, survey bench marks and monuments which may be affected by Work.
- .2 Protect existing surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.
- .3 Where required for excavation, cut roots or branches as approved by Departmental Representative.

## PART 2 - PRODUCTS

- 2.1 Materials .1 Granular bedding to Section 31 05 16 – Aggregates.
- .2 Trench backfill to Section 32 11 16 – Granular Sub-base

## PART 3 - EXECUTION

- 3.1 Site Preparation .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- 3.2 Stripping of Topsoil .1 Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds, and grasses.
- .2 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2m.
- .4 Dispose of unused topsoil as directed by Departmental Representative.
- 3.3 Stockpiling .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
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- 3.4 Cofferdams, Shoring, Bracing and Underpinning .1 Construct temporary Works to depths, heights, and at locations as required to protect existing structures, embankment slopes, roadway embankment fill, etc. If required, temporary works to be designed and stamped by a Professional Engineer registered in the Province of British Columbia.
- .2 During backfill operation:
- .1 Unless otherwise as indicated or as directed by Departmental Representative, remove sheeting and shoring from excavations.
- .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500mm above toe of sheeting.
- .3 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- 3.5 Dewatering and Heave Prevention .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs, if required.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Protection and in manner not detrimental to public and private property or any portion of Work completed or under construction.
- .6 Provide silt fences, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to water courses or drainage areas.
- 3.6 Excavation .1 Excavate to lines, grades, elevations and dimensions as indicated on the drawings or as required.
- .2 Perform wingwall / excavation work symmetrically about the centreline of bridge both longitudinally and transversely. i.e. soil pressure loads to be balanced on both abutments during the course of the work.
- .3 Excavate only the required soil underneath of the bridge to complete the work at hand (i.e. perform the excavation work in stages). Install the top parts of the wingwalls first and work downwards below ground. This will help eliminate the potential for embankment fill sloughing. Also, as work proceeds downwards, install the wall components
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between the concrete abutment columns first before outside of the concrete columns.

- .4 Excavation work to be as minimal as possible.
- .5 Excavation must not interfere with capacities of adjacent foundations and roadway fills. It is the Contractor's responsibility to determine if any temporary works are required to maintain stabilities during construction.
- .6 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .7 Dispose of surplus and unsuitable excavated material in approved location off site.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Notify Departmental Representative when bottom of excavation is reached.
- .11 Obtain Departmental Representative approval of completed excavation.
- .12 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with fill concrete.
  - .2 Fill under other areas with granular sub-base fill compacted to not less than 95% of corrected maximum dry density.
- .13 Hand trim, make firm, and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### 3.7 Backfilling

- .1 Do not proceed with backfilling operations until Departmental Representative has approved.
  - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
  - .3 Do not use backfill material that is frozen or contains ice, snow or debris.
  - .4 Place backfill material in uniform layers not exceeding 150mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
  - .5 Backfilling around installations:
    - .1 Place bedding and surround material as specified elsewhere.
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- .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously at both ends of the bridge to equalize loadings on the structure as a whole. Difference not to exceed 0.3m from one abutment to the other.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
    - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
  - .6 Install drainage system in backfill if indicated by Departmental Representative.
  - .7 Care must be taken next to existing structures and next to new structures when performing backfilling operations.
- 3.8 Restoration
- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Measurement for Payment .1 Payment for clearing and grubbing will be made under payment items in Section 31 11 00 - Clearing and Grubbing.
- .2 Payment for geosynthetic material will be made under payment items in Section 31 32 19 – Geotextiles.
- .3 Payment for excavation:
- .1 Shall be full compensation for all work necessary and incidental for excavation and disposal of surplus, unsuitable and waste materials including stripping; site drainage and all other related surface works within limits of the Work, or otherwise indicated, to the required subgrade elevations for the construction of road works and related facilities.
- .2 Measurement for payment for this item shall be at the unit price for each cubic meter of excavation as measured and accepted by the Departmental Representative.
- .5 Payment for embankment fill:
- .1 Shall be full compensation for all work necessary and incidental for placing granular fill material from approved subgrade to the underside of granular sub-base within the proposed road right-of-way, or otherwise indicated, for the construction of roadworks and other related surface works as indicated in the Contract Documents.
- .2 Subgrade elevation shall be determined by the lines, grades, and cross-sections for finished road surface elevations as indicated, less the minimum thicknesses for asphalt pavement, granular base and granular sub-base materials in accordance with the Contract Document and as directed by the Departmental Representative.
- .3 Payment for Contractor supplied embankment fill shall include, but not limited to: supplying, hauling, placing and compacting of granular material to finished subgrade elevation for construction of all surface works, and protection of the placed material to reasonably prevent such events that may affect the performance of the subgrade
- .4 Measurement for payment for embankment fill shall be at the unit price for each cubic metre of compacted granular sub-base placed to the specified thickness and density as measured and accepted by the Departmental Representative.
- .6 Payment for over-excavation and fill:
- .1 Shall be full compensation for all work necessary and incidental, over and above the cost of common excavation
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included elsewhere; for over-excavation of the subgrade including loading, hauling and off-site disposal of material; and supply, hauling, placing and compaction of embankment fill to the design subgrade in accordance with the Contract Documents and as directed by the Departmental Representative.

- .2 The Contractor shall expose the subgrade and notify the Departmental Representative in a timely manner in order that the Contractor's survey and layout be verified by the Departmental Representative prior to placing granular fill. Any materials removed prior to taking profile measurements will not be included in the computation of quantities for payment
- .3 Measurement for payment of this item will be at the unit price for each cubic metre based on 'in-place' measurements using average end area method as determined, measured and accepted by the Departmental Representative.

#### 1.2 References

- .1 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft) (600 kN-m/m).

#### 1.3 Definitions

- .1 Rock Excavation: excavation of:
    - .1 Material from solid masses of igneous, sedimentary or metamorphic rock that, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass.
    - .2 Boulder or rock fragments measuring in volume one cubic metre or more.
  - .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping Excavation.
  - .3 Stripping Excavation: excavation of organic material covering original ground.
  - .4 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
  - .5 Waste material: material other than Stripping Excavation that is unsuitable for embankment construction or material surplus to requirements.
  - .7 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
  - .8 Road Reclamation: excavation of existing road bed materials deemed acceptable for use as Embankment.
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- 1.5 Requirements of Regulatory Agencies .1 Adhere to Provincial and Federal Environmental requirements if potentially toxic materials are involved.
- 1.6 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

## PART 2 – PRODUCTS

- 2.1 Materials
  - .1 Granular materials in accordance with Section 31 05 16 – Aggregates.
  - .2 Geosynthetic material in accordance with Section 31 32 19 – Geotextiles
- 2.2 Specified Materials
  - .1 Embankment materials require approval by the Departmental Representative.
  - .2 Embankment may be:
    - .1 Approved native or imported granular material not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps, or any other unsuitable material.
    - .2 Pit run gravel
    - .3 Road reclamation meeting the pit run gravel specification
    - .4 Bulk rock fill
    - .5 Course crushed aggregate

## PART 3 - EXECUTION

- 3.1 General
    - .1 Clear and grub to the limits of excavation and/or embankment fill in accordance with Section 31 11 00 Clearing and Grubbing.
    - .2 Provide suitable temporary ditches or other suitable means of handling drainage prior to excavation and during construction to protect the construction area
    - .3 Comply with Section 01 35 43 Environmental Procedures.
  - 3.2 Stripping
    - .1 Commence topsoil stripping of areas as indicated after brush, weeds and grasses have been removed from these areas.
    - .2 Strip to depths as indicated or as necessary to remove all organic material.
    - .3 Do not mix topsoil with subsoil.
    - .4 Stockpile in locations in accordance with Contract Documents or as directed by Departmental Representative.
    - .5 Dispose of unused stripped topsoil in accordance with Contract
-

- Documents or as directed by Departmental Representative.
- .6 Prevent clearing and grubbing debris from mixing with stripped topsoil.
  - .7 Upon completion of excavation and embankment construction spread stripped topsoil on slopes and trim, as directed by the Departmental Representative.
- 3.3 Excavating
- .1 General:
    - .1 Notify Departmental Representative when unsuitable materials are encountered. Remove to depth and extent directed by Departmental Representative.
    - .2 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points in accordance with typical drawing, or as directed by Departmental Representative.
  - .2 Maintain profiles, crowns and cross slopes to provide good surface drainage.
  - .3 Road reclamation:
    - .1 If the Contractor wishes to use the existing road base material as embankment fill, notify the Departmental Representative. Contractor to confirm material meets the gradations of Pit Run Gravel. Material may be used at the discretion of the Departmental Representative.
  - .3 Rock Excavation:
    - .1 If, during excavation, material appearing to conform to classification for rock is encountered, notify Departmental Representative and provide sufficient time to take measurements to determine volume of rock.
    - .2 Shatter rock to 300mm below subgrade elevation or as indicated on plans, if required.
- 34 Inspection of Subgrade
- .1 Prior to placing any fill materials, proof roll graded native surface using a fully loaded single or dual axle dump truck in the presence of the Departmental Representative.
  - .2 Departmental Representative may authorize the use of other acceptable proof rolling equipment.
  - .3 Remove soft or other unsuitable material.
  - .4 Replace and compact with approved embankment fill. At the direction of the Departmental Representative, the Contractor to replace with course crushed aggregate and geotextiles.
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- 3.5 Placing
- .1 Place material only on clean unfrozen surfaces, properly shaped and compacted, free from snow and ice.
  - .2 Maintain crowned surface during construction to ensure ready run-off of surface water.
  - .3 Drain low areas before placing materials.
  - .4 Place materials using methods which do not lead to segregation or degradation to the full width in uniform layers and compacted to specified densities.
  - .5 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
  - .6 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved. Bulk rock fill in layers not exceeding 300 mm and compacted by a minimum of four passes of a 10 tonne vibratory roller or as directed by the Departmental Representative.
  - .7 Where material consists of rock:
    - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1m.
    - .2 Carefully distribute rock material to fill voids with smaller fragments to form compact mass.
    - .3 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
    - .4 Do not place boulders and rock fragments with dimensions exceeding 150mm within 300mm of subgrade elevation.
  - .8 Embankments to be sloped to Departmental Representative's requirements. Intent is that slopes be as gentle as possible within limitations of site geometry.
- 3.6 Compaction
- .1 Compaction equipment must be capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.
  - .2 Break material down to sizes that enable required compaction and mix for uniform moisture to full depth of layer.
  - .2 Compact each layer to minimum 95% maximum dry density, to ASTM D698 and ASTM D4718 except top 150mm of subgrade. Compact top 150 mm to 100% maximum dry density.
  - .3 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction. If material is
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excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction or remove material.

- 3.7 Finishing
- .1 Shape entire roadbed to within 25mm of design elevations and to Departmental Representative's satisfaction.
  - .2 Finish slopes and ditch bottoms to neat condition, true to lines, grades and drawings where applicable.
  - .3 Remove rocks over 150mm in any dimension from slopes and ditch bottoms.
  - .4 Hand finish slopes that cannot be finished satisfactorily by machine.
  - .5 Round top of backslope 1.5 m on both sides of top of slope.
  - .6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags, ruts, and protruding stones.
- 3.8 Protection
- .1 Maintain finished surfaces in condition conforming to this Section until placement of subsequent materials.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes .1 Materials and installation of polymeric geotextiles used in revetments, retaining wall structures, filtration, drainage structures road and trail beds and serves the purpose to:
- .1 Separate and prevent mixing of granular materials with the existing native subgrade.
  - .2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.
  - .3 Provide additional strength to sub-grade.
- 1.2 Measurement for Payment .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supplying and placing geotextiles to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: supply and installation of geotextiles and retaining pins, if required, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each square meter of geotextile installed as measured and accepted by the Departmental Representative. Overlap, as specified herein, to be considered incidental in the payment item.
- 1.3 References .1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2 ASTM D4595-86(2001), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .3 ASTM D4716-01, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .4 ASTM D4751-99a, 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, 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
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- 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/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
    - .2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - 1.4 Submittals
    - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
    - .2 Submit to Departmental Representative (if requested) following samples at least 4 weeks prior to beginning Work.
      - .1 Minimum length of 2 m of roll width of geotextile.
      - .2 Minimum of 1 m seam with at least 300 mm of geotextile on both sides of seam.
    - .3 Submit to Departmental Representative 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.
  - 1.5 Delivery and Storage
    - .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.
  - 1.6 Waste Management and Disposal
    - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
    - .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
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**PART 2 - PRODUCTS**

- 2.1 Material
- .1 Non-woven Geotextile:
    - .1 Composed of 100% polypropylene, non-woven, synthetic fibre fabric.
    - .2 Suppled in rolls, minimum 4.75 metres in width.
    - .3 Grab Tensile Strength > 700 N (ASTM-D4632)
    - .4 CBR Puncture > 1800 N (ASTM-D6241)
    - .5 Based on general physical properties outlined above, equivalent geotextiles would be Nilex 4551.
  - .2 Biaxial Geogrid:
    - .1 Composed of: 100% by polypropylene, open grid, biaxial orientation, free of striations, roughness, pinholes, blisters, undispersed raw materials or any sign of contamination by foreign matter.
    - .2 Suppled in rolls, minimum 4.75 metres in width.
    - .3 Tensile Strength at 2% Strain: 6.0 kN/m (MARV)
    - .4 Flexural Stiffness: 750,000 mg-cm
    - .5 Based on general physical properties outlined above, equivalent biaxial geogrids would be Tensar Biaxial Geogrid, Type 2
  - .3 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.
- 2.2 Material Supplied By Owner
- .1 The Owner has 123 rolls (17ft x 265ft per roll) of Mirafi HP570 geotextile that can be used in lieu of the non-woven geotextile.
  - .2 Geotextile rolls are located at the sewage lagoon within the Park. Access road to the sewage lagoon is north of the Wick Road access off Highway 4.
  - .3 Material usage will be quantified and monitored by the Departmental Representative.

**PART 3 - EXECUTION**

- 3.1 Installation
- .1 Prepare subgrade by grading to provide a smooth, uniform surface. Remove all stumps, large rock, brush or other debris that could damage the fabric. Fill all holes and depressions so that the fabric does not
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bridge them. Replace loose or unstable soils.

- .2 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated. Retain in position with retaining pins if required.
- .3 Place geotextile material smooth in a loose fashion and free of tension stress, folds, wrinkles and creases.
- .4 Place geotextile material on surfaces in one continuous length.
- .5 Overlap each successive strip of geotextile over previously laid strip. Fabric lap in accordance with manufacturer's recommendations and minimum 1000mm lap for woven and 300mm lap for non-woven.
- .6 Take care to prevent puncturing or tearing the geotextile. Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers. Repair all damage by use of patches that extend at least 1.0 m beyond the perimeter of the tear or puncture.
- .7 After installation, cover with overlying granular layer within sufficient time so that ultraviolet damage does not occur. In no case shall this time exceed 7 days for ultraviolet susceptible material and 14 days for ultraviolet protected and low ultraviolet susceptible polymer geotextiles.
- .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .9 For geotextiles under rip-rap commence rip-rap placement at the base of the blanket area and proceed up the slope. Limit the height of drop of rip-rap to 1.0m or less. Do not allow the rip-rap to roll down the slope.

### 3.2 Protection

- .1 No vehicles permitted directly on geotextile.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling and placing of riprap to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: supply and placement, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each square meter of riprap placed to the specified thickness, based on the riprap class as measured and accepted by the Departmental Representative.

**PART 2 – PRODUCTS**

- 2.1 Stone .1 Hard, dense, durable quarry stone, angular in shape, resistant to weathering and water action, free from overburden, spoil, shale or shale seams, and organic material, Care shall be taken to avoid introducing evasive plants into the park by using clean materials. All stones having maximum dimension not greater than three times its least dimension, to meet following size distribution:

Class of Riprap (kg)	Nominal Thickness of Riprap (mm)	Rock Gradation: Percentage Larger Than Given Rock Mass		
		85%	50%	15%
10	350	1 kg	10 kg	30 kg
25	450	2.5 kg	25 kg	75 kg
50	550	5 kg	50 kg	150 kg

- .2 The minimum acceptable unit weight of the rock is 2.5 tonnes/cubic metre.
- 2.2 Geotextile Filter .1 Geotextile: in accordance with Section 31 32 19 – Geotextile.
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**PART 3 - EXECUTION**

- 3.1 Processing .1 Process riprap uniformly using methods that prevent contamination, segregation, and degradation.
- 3.2 Handling .1 Handle and transport riprap to avoid segregation, contamination, and degradation.
- 3.4 Placing .1 Where riprap is to be placed on slopes, excavate trench at toe of slope first, if and where instructed by the Departmental Representative.
- .2 Where riprap is to be placed, fine grade the area first to provide a uniform and even surface, if and where instructed by the Departmental Representative. Fill any depressions with suitable materials and compact to provide a firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19 – Geotextiles and as indicated. Avoid puncturing geotextile. Vehicle Traffic over geotextile is not permitted.
- .4 Place rip-rap to thickness and detailed as indicated on the drawing.
- .5 Place stones to secure the surface of the slope and create a stable mass. Place larger stones at the bottom of the slopes.
- .6 Use larger stones for lower courses and as headers for subsequent courses.
- .7 Stagger vertical joints and fill voids with rock spalls or cobbles.
- .8 Finished surface to be reasonably uniform and even, free from bumps, depressions, underlying voids, large openings, or individual stones projecting out above apparent surface.
- .9 Place riprap prior to permitting water to pass through slope drains, as applicable.
- .8 Be careful not the damage the structure (new and existing components) in any way during riprap movement. Any damages shall be repaired at the expense of the Contractor.
- .10 Place layers simultaneously at both ends of the bridge to equalize loadings on the structure as a whole. Difference not to exceed 0.3m from one abutment to the other.
- .11 Embankments to be sloped to Departmental Representative's requirements. Intent is that slopes be as gentle as possible within limitations of site geometry. Intent is that slopes to be reinforced with riprap to prevent future roadway embankment and river slope erosion, scour, migration, etc.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling, placing, rolling and compaction of 300mm thickness of granular sub-base to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: supply and application of water as required to meet specified density, compaction testing to confirm compliance with specifications, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the unit price for each square meter of compacted granular sub-base placed to the specified thickness and density as measured and accepted by the Departmental Representative.
- 1.2 References
- .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .4 ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
  - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
  - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - .7 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .8 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
-

**PART 2 - PRODUCTS**

2.1 Materials .1 Granular Sub-base: material to Section 31 05 16 – Aggregates following requirements:

- .1 Crushed stone or gravel.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.1 Gradation to:

<b>Sieve Designation</b>	<b>% Passing</b>
75 mm	100
38 mm	60 – 100
19 mm	35 – 80
9.5 mm	26 – 60
4.75 mm	20 – 40
2.36 mm	15 – 30
1.18 mm	10 – 20
0.600 mm	5 – 15
0.300 mm	3 – 10
0.075 mm	0 – 5

- .2 Liquid limit: to ASTM D4318, maximum 25.
- .3 Plasticity index: to ASTM D4318, maximum 6.
- .4 Crushed particles: 60% of the material passing each sieve must have one or more fractured faces.

2.2 Materials Supplied By  
Owner

- .1 The Owner has a stockpile of granular material conforming to the gradations specified above.
  - .2 Available stockpiled material is approximately 6,400 (loose) cubic metres
  - .3 Material is located at Dolan's Concrete pit. Access road to the pit is south of the Highway 4 / Tofino Ucluelet Highway junction.
  - .4 Material will be loaded and weighed on the pit Owner's scale. Scale information slips to be presented to Departmental Representative on a daily basis.
  - .5 Material usage will be quantified and monitored by the Departmental Representative.
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**PART 3 – EXECUTION**

- 3.1 Sequence of Operation
- .1 Stockpile Granular Sub Base off site as specified under Section 31 05 16 – Aggregates.
  - .2 Place Granular Sub-base after subgrade is inspected and accepted by Departmental Representative.
  - .3 Placing:
    - .1 Construct Granular Sub-base to depth and grade in areas indicated.
    - .2 Ensure no frozen material is placed.
    - .3 Place material only on clean unfrozen surface, properly shaped and compacted, and free from snow and ice.
    - .4 Begin spreading sub-base material on crown line or on high side of one-way slope.
    - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
    - .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
    - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
    - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
  - .4 Compaction Equipment:
    - .1 Compaction equipment to be capable of obtaining required material densities.
  - .5 Compacting:
    - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698-00a and D4718.
    - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
    - .3 Apply water as necessary during compacting to obtain specified density.
    - .4 Dry gravel if granular sub-base is excessively moist.
    - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
    - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
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- 3.2 Site Tolerances .1 Finished sub-base surface to be within plus or minus 15 mm of established grade and cross section and specified thickness.
- 3.3 Maintenance .1 Maintain finished Granular Sub-base in condition conforming to this Section until acceptance by Departmental Representative and until succeeding material is applied.
- .2 Apply dust control measures as required.
- .3 Ensure that Granular Sub-base surface is in properly compacted state prior to application of succeeding material.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment
- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling, placing, rolling and compaction of crushed gravel granular base to the lines, grades and cross-sections indicated in the Drawings and as directed by the Departmental Representative.
  - .2 The prices bid shall include, but not be limited to: supply and application of water as required to meet specified density, compaction testing to confirm compliance with specifications, and all other work and materials necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for granular base shall be at the unit price for each square meter of compacted granular sub-base placed to the specified thickness and density as measured and accepted by the Departmental Representative.
  - .4 Measurement for payment for shouldering gravel shall be at the unit price for each square meter of compacted granular sub-base material placed to the specified thickness and density as measured and accepted by the Departmental Representative.
- 1.2 References
- .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .5 ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
  - .6 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
  - .7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - .9 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .10 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
-



**PART 2 - PRODUCTS**

- 2.1 Materials .1 Granular base: material to Section 31 05 16 - Aggregates and following requirements:
- .1 Crushed stone or gravel. Material shall be completely free of evasive species of vegetation through using clean crushed rock or washed materials.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

- .1 Gradation to:

<b>Sieve Designation</b>	<b>% Passing</b>
25 mm	100
19 mm	80 - 100
9.5 mm	50 - 85
4.75 mm	35 - 70
2.36 mm	25 - 50
1.18mm	15 - 35
0.300 mm	5 - 20
0.180 mm	-
0.075 mm	1 - 5

- .2 Liquid limit: ASTM D4318, max. 25.
- .3 Plasticity index: ASTM D4318, max. 6.
- .4 Crushed Particles: 60% of the material passing each sieve must have one or more fractured faces.

**PART 3 – EXECUTION**

- 3.1 Sequence of Operation .1 Stockpile Granular Base off site as specified under Section 31 05 16 – Aggregates.
- .2 Place Granular Base after underlying surface is to within tolerances.
- .3 Placing:
- .1 Construct Granular Base to depth and grade in areas indicated.
- .2 Ensure no frozen material is placed.
- .3 Place on clean unfrozen surface, properly shaped and compacted, free from snow and ice.
- .4 Begin spreading base material on crown line or on high side of one-way slope.
- .5 Place material using methods which do not lead to segregation or degradation of aggregate.
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- .6 Place material to full width in uniform layers not exceeding 100 mm compacted thickness.
- .7 Shape layer to smooth contour and compact to specified density before proceeding to paving.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .9 Place shouldering gravels upon completion of paving to the dimensions shown on the contract drawings. Compact material as described in 3.1.5 of this specification. Sweep asphalt surface upon completion of placing shoulder gravel.
- .4 Compaction Equipment:
  - .1 Compaction equipment to be capable of obtaining required material densities.
- .5 Compacting:
  - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698 and D4718.
  - .2 Shape and roll alternately to obtain smooth, even, and uniformly compacted base.
  - .3 Apply water as necessary for compacting to obtain specified density.
  - .4 Dry gravel if Granular Base is excessively moist.
  - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
  - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- 3.2 Site Tolerances
  - .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section or as directed by Departmental Representative.
- 3.3 Maintenance
  - .1 Maintain finished Base in condition conforming to this Section until acceptance by Departmental Representative and until succeeding material is applied.
  - .2 Apply dust control measures as required.
  - .3 Ensure that Granular Base surface is in properly compacted state prior to application of succeeding material.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement Procedures .1 No separate payment will be made for asphalt prime coat. Payment for asphalt prime coat is considered as incidental to the work and to be included in the relevant unit prices in this contract.
- 1.2 References .1 American Association of State Highway and Transportation Officials (AASHTO)
- .1 AASHTO M081-92-UL-04, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
- .2 ASTM International
- .1 ASTM D140/D140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 ASTM D633-11, Standard Volume Correction Table for Road Tar.
- .3 ASTM D1250-08, Standard Guide for Use of the Petroleum Measurement Tables.
- .3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.3 Action and Informational Submittals .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt tack coat and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
- .1 Submit two - 4 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth containers to Departmental Representative, at least 2 weeks prior to beginning Work.
- .2 Sample asphalt tack coat material to: ASTM D140.
- .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work to ASTM D140.
- 1.4 Quality Assurance .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.
-

- 1.5 Delivery, Storage and Handling
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements with manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Storage and Handling Requirements:
    - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Replace defective or damaged materials with new.
  - .4 Deliver, store and handle materials in accordance with ASTM D140.
  - .5 Provide, maintain and restore asphalt storage area.
- 1.6 Waste Management and Disposal
- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

## PART 2 - PRODUCTS

- 2.1 Materials
- .1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.
  - .2 Water: clean, potable, free from foreign matter.
- 2.2 Equipment
- .1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.
  - .2 Pressure distributor:
    - .1 Designed, equipped, maintained and operated so that asphalt material can be:
      - .1 Maintained at even temperature.
      - .2 Applied uniformly on variable widths of surface up to 5 m.
      - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m<sup>2</sup>.
      - .4 Distribute in uniform spray without atomization at temperature required.
    - .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
    - .3 Equipped with pump having flow meter graduated in units of
-

- 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
- .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
    - .1 Measure temperature to closest whole number.
  - .5 Equipped with accurate volume measuring device or calibrated tank.
  - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
  - .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
  - .8 Cleaned if previously used with incompatible asphalt material.

### PART 3 - EXECUTION

- 3.1 Examination
    - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt tack coat installation in accordance with manufacturer's written instructions.
      - .1 Visually inspect substrate in presence of Departmental Representative.
      - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
      - .3 Proceed with installation only after unacceptable conditions have been remedied.
  - 3.2 Application
    - .1 Apply asphalt tack coat only on clean and dry surface.
    - .2 Dilute asphalt emulsion with water at 1:1 ratio for application.
      - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
    - .3 Apply asphalt tack coat evenly to pavement surface at rate as required but not to exceed 0.7 L/m<sup>2</sup> when diluted with water at 1:1 ration.
    - .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
    - .5 Apply asphalt tack coat only when air temperature greater than 5 degrees C and when rain is not forecast within 2 hours minimum of application.
-

- .6 Apply asphalt tack coat only on unfrozen surface.
  - .7 Apply tack coat only to surfaces that are expected to be overlaid on same day.
  - .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
  - .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
  - .10 Keep traffic off tacked areas until asphalt tack coat has set.
  - .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
  - .12 Permit asphalt tack coat to cure before placing asphalt pavement.
  - .13 Carry out measurements in presence of Departmental Representative upon request.
  - .14 Inspect tack coat application to ensure uniformity.
    - .1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Departmental Representative.
    - .2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.
- 3.3 Cleaning
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement Procedures .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply and placing of asphalt prime coat to the lines, grades and cross-sections indicated for designated asphaltic pavement areas as indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: priming of prepared surfaces; and all other work and materials incidental and necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each neat square metre of asphalt prime coat placed, measured and accepted by the Departmental Representative.
- 1.2 References .1 ASTM International
- .1 ASTM D140/D140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.
- .2 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.3 Action and Informational Submittals .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt prime coat and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
- .1 Submit two 4 L samples of asphalt prime proposed for use in new, clean, air tight sealed, wide mouth containers, to Departmental Representative, 2 weeks prior to commencing Work.
- .2 Sample asphalt prime coat materials in accordance with ASTM D140.
- .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.
- 1.4 Quality Assurance .1 Upon request from Departmental Representative, submit manufacturer's
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test data and certification that asphalt prime material meets requirements of this Section.

- 1.5 Delivery, Storage and Handling
- .1 Deliver materials in accordance with Section 01 61 00 - Product Requirements with manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .1 Arrange points of delivery and quantity to be shipped with vendor.
    - .2 Make deliveries during normal work hours.
    - .3 Include copy of orders and instructions respecting shipment upon request by Departmental Representative.
    - .4 Include suitable unloading facilities and unload asphalt as directed Departmental Representative.
    - .5 Provide, maintain and restore asphalt storage area.
  - .3 Storage and Handling Requirements:
    - .1 Deliver, store and handle materials to ASTM D140.
    - .2 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .3 Replace defective or damaged materials with new.

## PART 2 - PRODUCTS

- 2.1 Material
- .1 Asphalt material: to CAN/CGSB-16.1 grade RM-20, MC-70 or CAN/CGSB-16.2 grade SS-1h.
  - .2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
  - .3 Water: clean, potable, free from foreign matter.
- 2.2 Equipment
- .1 Pressure distributor:
    - .1 Designed, equipped, maintained and operated so that asphalt material can be:
      - .1 Maintained at even temperature.
      - .2 Applied uniformly on variable widths of surface up to 5 m.
      - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with allowable variation from any specified rate not
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- exceeding 0.1 L/m<sup>2</sup>.
- .4 Distribute in uniform spray without atomization at temperature required.
- .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
- .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
- .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
  - .1 Measure temperature to closest whole number.
- .5 Equipped with accurate volume measuring device or calibrated tank.
- .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
- .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
- .8 Cleaned if previously used with incompatible asphalt material.
- .2 Aggregate Spreader:
  - .1 Apply blotter sand to primed surfaces using roll type spreader, or rotating disc sander capable of applying aggregate at variable widths and at variable rates.

### PART 3 - EXECUTION

- 3.1 Examination
    - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt prime coat installation in accordance with manufacturer's written instructions.
      - .1 Visually inspect substrate in presence of Departmental Representative.
      - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
      - .3 Proceed with installation only after unacceptable conditions have been remedied.
  - 3.2 Application
    - .1 Proceed with application of prime coat only after receipt of approval of
-

- granular base surface from Departmental Representative.
  - .2 Cutback asphalt:
    - .1 Heat MC70 asphalt prime to between 60 and 70 degrees C for pumping and spraying in accordance with manufacturer's instructions.
    - .2 Apply asphalt prime to granular base at rate as required but not to exceed 2 L/m<sup>2</sup>.
    - .3 Apply on damp surface unless otherwise directed by Departmental Representative.
  - .3 Emulsified asphalt:
    - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.
    - .2 Mix thoroughly by pumping or other method approved by Departmental Representative.
    - .3 Apply diluted asphalt emulsion at rate as required but do not exceed 5 L/m<sup>2</sup>.
    - .4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.
  - .4 Apply asphalt prime only on unfrozen surface.
  - .5 Apply asphalt prime coat only when air temperature is greater than 5 degrees C and when rain is not forecast within 2 hours minimum of application.
  - .6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.
  - .7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
  - .8 Prevent overlap at junction of applications.
  - .9 Do not prime surfaces that will be visible when paving is complete.
  - .10 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.
  - .11 Keep traffic off primed areas until asphalt prime has cured.
  - .12 Permit prime to cure before placing asphalt paving.
  - 3.3 Use of Sand Blotter
    - .1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.
    - .2 Allow sufficient time for excess prime to be absorbed.
    - .3 Apply second application of sand blotter as required.
    - .4 Do not roll blotter sand.
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- .5 Sweep and remove excess blotter material.
- 3.4 Cleaning
  - .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**PART 1 - GENERAL****1.1 Measurement and  
Payment**

- .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply, hauling, placing, rolling and compaction of hot mix asphaltic concrete pavement to the lines, grades and cross-sections indicated for designated areas as indicated in the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: provision of mix designs; tack coating of prepared surfaces as required; joint preparation; adjusting and cleaning of castings; supply, placing, rolling and compaction of the specified compacted thickness hot mix asphaltic concrete; testing; temporary pavement markings; and all other work and materials incidental and necessary to complete this portion of the Work to the satisfaction of the Departmental Representative.
- .3 Measurement for payment for this item shall be at the unit price for each neat square metre of compacted asphaltic concrete of type indicated, placed to the specified thickness as measured and accepted by the Departmental Representative.

**1.2 References**

- .1 Asphalt Institute (AI)
    - .1 AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
  - .2 ASTM International
    - .1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
    - .2 ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
    - .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
    - .4 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
    - .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
    - .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
    - .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
    - .8 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
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- .9 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
  - .10 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
  - .11 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
  - .12 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- 1.3 Action and Informational Submittals
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Product Data: Upon request of Departmental Representative, submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3 Mix Design: Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning Work.
- 1.4 Delivery, Storage and Handling
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.

**PART 2 - PRODUCTS**

- 2.1 Material
- .1 Performance graded asphalt cement: to CGSB-16.3-M90, Grade 80-100.
  - .2 RAP:
    - .1 Crushed and screened to ensure 100% of RAP material passes 37.5 mm screen before mixing.
  - .3 Aggregates: in accordance with Section 31 05 16 - Aggregate and requirements as follows:
    - .1 Crushed stone or gravel.
    - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117.
-

.3 Table:

Sieve Designation	% Passing
19 mm	100
12.5 mm	84 – 99
9.5 mm	73 – 88
4.75 mm	55 – 68
2.36 mm	35 – 55
1.18 mm	27 – 46
0.600 mm	18 – 36
0.300 mm	10 – 26
0.150 mm	4 – 17
0.075 mm	3 – 8

.4 Coarse aggregate: aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.

.5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.6 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.7 Sand equivalent: ASTM D2419. Min: 40.

.8 Magnesium Sulphate soundness: to ASTM C88. Max% loss by mass:

.1 Coarse aggregate: 15%.

.2 Fine aggregate: 18%.

.9 Los Angeles degradation: Grading B, to ASTM C131. Max% loss by mass:

.1 Coarse aggregate, surface course: 25%.

.10 Absorption: to ASTM C127. Max% by mass:

.1 Coarse aggregate, surface course: 1.75%.

.11 Loss by washing: to ASTM C117. Max% passing 0.075 mm sieve:

.1 Coarse aggregate, surface course: 1.5%.

.12 Lightweight particles: to ASTM C123. Max% by mass less than 1.95 relative density:

.1 Surface course: 1.5%.

.13 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max% by mass:

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.1 Coarse aggregate, surface course: 10%.

- .14 Crushed fragments: at least 60% of particles by mass within each of following sieve designation ranges, to have at least 2 freshly fractured faces. Material to be divided into ranges, using methods of ASTM C136.

Passing		Retained on
25 mm	to	12.5 mm
12.5 mm	to	4.75mm

- .15 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.4 Mineral filler:

- .1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by Departmental Representative are thoroughly dry and free from lumps.
- .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.
- .3 Ensure mineral filler is dry and free flowing when added to aggregate.

## 2.2 Equipment

- .1 Pavers: mechanical [grade controlled] self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
- .1 Drum diameter: 1200 mm minimum.
- .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
- .1 Boxes with tight metal bottoms.
- .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
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.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm<sup>2</sup> for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

### 2.3 Mix Design

.1 Mix design to be approved in writing by Departmental Representative.

.2 Mix may contain maximum 20% by mass of RAP. Departmental Representative may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 75.

.2 Mix physical requirements:

Property		Roads
Marshall Stability at 60°C	kN min	5.5
Flow Value	mm	2 - 4
Air Voids in Mixture	%	3 - 5
Voids in Mineral Aggregate	% min	15
Index of Retained Stability	% min	75

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to ASTM D1559.

.2 Air voids: to ASTM D3203.

.3 Index of Retained Stability: measure in accordance with Marshall Immersion Test ASTM D1559.

.4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided and approved by Departmental Representative.

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**PART 3 - EXECUTION****3.1 Plant and Mixing  
Requirements**

- .1 Batch and continuous mixing plants:
  - .1 To ASTM D995.
  - .2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
    - .1 Do not load frozen materials into bins.
  - .3 Feed cold aggregates to plant in proportions to ensure continuous operations.
  - .4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
  - .5 Before mixing, dry aggregates to moisture content not greater than 0.5% by mass or to lesser moisture content if required to meet mix design requirements.
  - .6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
  - .7 Store hot screened aggregates in manner to minimize segregation and temperature loss.
  - .8 Maintain temperature of materials within 5° C of specified mix temperature during mixing.
  - .9 Mixing time:
    - .1 In batch plants, dry mix for hot less than 10s. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.
    - .2 In continuous mixing plants, mixing time as required but not less than 45s.
  - .10 Where RAP is to be incorporated into mix:
    - .1 Feed from separate cold feed bin specially designed to minimize consolidation of material.
      - .1 Provide 37.5 mm scalping screen on cold feed to remove oversized pieces of RAP.
    - .2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti rollback device to prevent material from sliding backward on feed belt.
    - .3 Combine RAP and new aggregates in proportions as specified. Dry mix thoroughly, until uniform temperature within plus or minus 5° C of mix

temperature is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dried mix material is above 160° C.

- .2 Dryer drum mixing plant:
  - .1 To ASTM D995.
  - .2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.
  - .3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
  - .4 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180° C.
  - .5 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.
  - .6 Meter total flow of aggregate and RAP using electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump to ensure proportions of aggregate, RAP and asphalt entering mixer remain constant.
  - .7 Allow for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.
  - .8 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
    - .1 Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time.
    - .2 Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.
  - .9 Make provision for conveniently sampling full flow of materials from cold feed.
  - .10 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.
  - .11 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

- .12 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream.
  - .1 Control heating to prevent fracture of aggregate or excessive oxidation of asphalt.
  - .2 Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator.
- .13 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is 0.5% maximum.

.3 Temporary storage of hot mix:

- .1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.
- .2 Do not store asphalt mix in storage bins in excess of 12 hour.

.4 Mixing tolerances:

- .1 Permissible variation in aggregate gradation from job mix (percent of total mass).

4.75 mm sieve and larger	5.5
2.36 mm sieve	4.5
0.600 mm sieve	3.5
0.150 mm sieve	2.5
0.075 mm sieve	1.5

- .2 Permissible variation of asphalt cement from job mix: 0.25%.
- .3 Permissible variation of mix temperature at discharge from plant: 5° C.

3.2 Preparation

- .1 Reshape granular roadbed.
- .2 When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .3 Apply prime coat and/or tack coat in accordance with Section prior to paving.
- .4 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 Transportation of Mix

- .1 Transport mix to job site in vehicles cleaned of foreign material.
-

- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.
    - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
  - .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
  - .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
    - .1 Do not dribble mix into trucks.
  - .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
  - .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within specified range, but not less than 125° C.
- 3.4 Placing
- .1 Obtain Departmental Representative's approval of base, existing surface, tack coat, or prime coat prior to placing asphalt.
  - .2 Place asphalt concrete to thicknesses, grades and lines as indicated.
  - .3 Placing conditions:
    - .1 Place asphalt mixtures only when air temperature is 5° C minimum.
    - .2 When temperature of surface on which material is to be placed falls below 10° C, provide extra rollers as necessary to obtain required compaction before cooling.
    - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
  - .4 Place asphalt concrete in compacted lifts of thickness as indicated.
  - .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
  - .6 Spread and strike off mixture with self propelled mechanical finisher.
    - .1 Construct longitudinal joints and edges true to line markings. Position and operate paver to follow established line closely.
    - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 3 m apart.
    - .3 Maintain constant head of mix in auger chamber of paver during placing.
-

- .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
  - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
  - .6 Correct irregularities in surface of pavement course directly behind paver.
  - .7 Do not throw surplus material on freshly screeded surfaces.
  - .7 When hand spreading is used:
    - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
    - .2 Distribute material uniformly without broad casting material.
    - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
    - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
    - .5 Provide heating equipment to keep hand tools free from asphalt.
      - .1 Control temperature to avoid burning material.
      - .2 Do not use tools at higher temperature than temperature of mix being placed.
  - 3.5 Compacting
    - .1 Roll asphalt continuously using established rolling pattern for test strip and to density of not less than 97% of 75 blow Marshall density in accordance with ASTM D1559 with no individual test less than 95%.
    - .2 General:
      - .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
      - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
      - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
      - .4 Use static compaction for levelling coarse less than 25 mm thick.
-

- .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
  - .6 Overlap successive passes of roller by at least one half width of roller mm and vary pass lengths.
  - .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
  - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
  - .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
  - .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
    - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
  - .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
  - .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
  - .3 Breakdown rolling:
    - .1 Begin breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
    - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
    - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.
    - .4 Use only experienced roller operators.
  - .4 Intermediate rolling:
    - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
    - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
-

- .5 Finish rolling:
    - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
      - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
    - .2 Conduct rolling operations in close sequence.
  - 3.6 Joints
    - .1 General:
      - .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
      - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
      - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
    - .2 Transverse joints:
      - .1 Offset transverse joint in succeeding lifts by at least 600mm.
      - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
      - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
    - .3 Longitudinal joints:
      - .1 Offset longitudinal joints in succeeding lifts by at least 150mm.
      - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100° C prior to paving of adjacent lane.
        - .1 For airfield runway paving, avoid cold joint construction in mid 30 m of runway.
        - .2 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
      - .3 Overlap previously laid strip with spreader by 100 mm.
      - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
      - .5 Roll longitudinal joints directly behind paving operation.
-

- .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150mm extending onto previously placed and compacted lane.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.
  - .1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.
  - .2 Locate feather joints as indicated.
- .5 Construct butt joints as indicated.
- 3.7 Finish Intolerances
  - .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
  - .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.
- 3.8 Defective Work
  - .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
  - .2 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- 3.9 Cleaning
  - .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning

**END OF SECTION**

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**PART 1 - GENERAL**

- |                                   |    |  |
|-----------------------------------|----|--|
| 1.1 Measurement for Payment       | .1 | No separate payment will be made for dust control. Payment for dust control is considered as incidental to the work and to be included in the relevant unit prices in this contract. |
|                                   | .2 | Supply and apply calcium chloride as part of dust control only if directed to do so by the Departmental Representative.  |
| 1.3 References                    | .1 | Canadian General Standards Board (CGSB):   |
|                                   | .1 | CAN/CGSB-15.1, Calcium Chloride.   |
| 1.4 Delivery Storage and Handling | .1 | Supply calcium chloride in quantities and at times as directed by Departmental Representative.   |
|                                   | .2 | Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.   |
|                                   | .3 | Store bags of calcium chloride in weather-proof enclosures.  |
|                                   | .4 | Supply calcium chloride as 35% aqueous solution.   |
| 1.5 Waste Management and Disposal | .1 | Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.  |
|                                   | .2 | Place materials defined as hazardous or toxic in designated containers.  |

**PART 2 - PRODUCTS**

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|---------------|----|--|
| 2.1 Materials | .1 | Calcium chloride flakes: to CAN/CGSB-15.1, Type S: Grade 1 (77%), Class A.   |
|               | .2 | Aqueous calcium chloride: to CAN/CGSB-15.1, Class 1 or 2, 35% concentration by weight of anhydrous product.                  |
|               | .3 | Water: to Departmental Representative's approval.  |
|               | .4 | Aqueous magnesium chloride or calcium chloride may be used provided application is not in an environmentally harmful manner. |
|               | .5 | Lignosulphates and used oil or "cut back" bitumen products are not permitted.  |
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**PART 3 - EXECUTION**

- 3.1 Application
- .1 Control dust at all times for the duration of the Contract.
  - .2 Apply water and aqueous solutions with distributors equipped with means of shutoff and with spray systems to ensure uniform application.
  - .3 Apply aqueous solutions at the following rates:
    - .1 Calcium chloride (25%) at 2.4 L/sqm on roads not previously treated and 3.0 L/sqm for road stabilization.
    - .2 Calcium chloride (35%) or magnesium chloride (30%) at 1.6 L/sqm on roads not previously treated and 2.0 L/sqm for road stabilization.
  - .4 Apply flake calcium chloride uniformly at a rate of 1.00 kg/sqm unless otherwise directed.
  - .5 Immediately after applying calcium chloride flakes, apply water until calcium chloride spreads to edge of roadway.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Payment Procedure .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supplying and placing pavement markings as indicated in the Drawings and as directed by the Departmental Representative.
- .2 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities. Temporary marking tape to be considered incidental in the payment item.
- 1.2 References .1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.5, Low Flash Petroleum Spirits Thinner.
- .2 CAN/CGSB 1.74, Alkyde Traffic Paint.
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).
- 1.3 Action and Informational Submittals .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Samples:
- .1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.
- .1 Two 1 L samples of each type of paint.
- .2 One 1 kg sample of glass beads.
- .3 Sampling to CGSB 1-GP
- .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number, formulation number and batch number.
- 1.4 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Product Requirements.
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- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

## PART 2 - PRODUCTS

### 2.1 Materials

- .1 Paint:
  - .1 To CSGB 1-GP-74M, alkyd traffic marking.
  - .2 To CSGB 1-GP-149M, alkyd reflectorized traffic marking.
  - .3 Colour: to CSGB 1-GP-12C, yellow 505-308, black 512-301 and white 513-301.
- .2 Thinner: to CSGB 1-GP-5M.
- .3 Glass reflective beads: Overlay type to CSGB 1-GP-74M, suitable for application to wet paint surface for light reflectance.
- .4 Temporary pavement marking tape:
  - .1 Material composition shall be at the discretion of the manufacturer subject to the approval of the Departmental Representative. Each formulation shall be identified by a code number.
  - .2 The colour of the marking to be brilliant white or yellow at the discretion of the Departmental Representative. The brightness value shall exceed 70% for the white and 45% for yellow obtained with a Gardner Multi-purpose Reflectometer when measuring 0 - 45 degrees C daylight luminous directional reflectance with the green filter.

## PART 3 - EXECUTION

- 3.1 Examination
    - .1 Pavement surface to be dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
  - 3.2 Equipment Requirements
    - .1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.
    - .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.
  - 3.3 Application
    - .1 Lay out pavement markings.
    - .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is
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- less than 60 km/h and no rain is forecast.
- .3 Apply traffic paint evenly at rate of 3 m<sup>2</sup>/L.
  - .4 Do not thin paint unless approved by Departmental Representative.
  - .5 Symbols and letters to dimensions indicated.
  - .6 Paint lines: of uniform colour and density with sharp edges.
  - .7 Thoroughly clean distributor tank before refilling with paint of different colour.
  - .8 Apply glass beads at rate of 0.5 kg/l of painted area immediately after application of paint.
- 3.4 Tolerance .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- 3.5 Protection of Completed Work .1 Protect pavement markings until dry.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Payment Procedure .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for the supply and installation of all traffic signage; relocation of signage, including posts, bases and hardware as indicated in the Drawings and as directed by the Departmental Representative.
- .2 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities.
- 1.2 References .1 ASTM International
- .1 ASTM B221M, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
- .2 ASTM B209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM D4956, Standard Specification for Retro-reflective Sheeting for Traffic Control
- .2 CSA Canadian Standards Association
- .1 CSA 0121M-1978, Douglas Fir Plywood
- .3 Sign Pattern Manual, British Columbia.
- .4 Specifications for Standard Highway Sign Materials, Fabrication and Supply – BC Ministry of Transportation and Infrastructure, latest edition.
- .5 2012 Standard Specifications for Highway Construction – BC Ministry of Transportation and Infrastructure, latest edition.
- 1.3 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

**PART 2 - PRODUCTS**

- 2.1 Materials .1 Signs
- .1 Must be retro-reflective to show the same colour, shape and message at night as they appear in daytime.
- .2 Conform to the Specifications for Standard Highway Sign Materials, Fabrication and Supply – BC Ministry of Transportation and Infrastructure, latest edition
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- .2 Posts
  - .1 Sign posts shall be perforated square steel tubing formed from 12 gauge, hot rolled steel, conforming to ASTM A101, Grade 50.
  - .2 Tubing shall be hot dipped galvanized conforming to ASTM A653 G-90 or CSA G164.
  - .3 Tubing shall have 7/16" holes on all four sides on 1" centres.
  - .4 Outside dimensions to conform to Drawing SP635-3.6.1, 2012 Standard Specifications for Highway Construction.
- .3 All hardware, nuts, bolts, washers, to be stainless steel.
- .4 Base to be concrete, pre-cast or poured-in-place, conforming to Drawing SP635-1.1.35 or Drawing SP635-1.1.44, 2012 Standard Specifications for Highway Construction.

### PART 3 - EXECUTION

#### 3.1 Installation

- .1 Concrete base shall be installed 25mm above finished grade except where installed in pavement it shall be flush with surface with no chamfered edge.
- .2 If poured-in-place, concrete to have attained a compressive strength of 30MPa prior to post installation.
- .3 All bases to have an inner sleeve.
- .4 Square tubing posts to be supplied in continuous lengths, with no splices, and shall be field cut to suit the particular installation. All field cuts to be painted with cold galvanizing compound.
- .5 Posts to be installed plumb.
- .6 Install sign to post and post to concrete base with hardware to conform to Drawing SP635-3.6.1, 2012 Standard Specifications for Highway Construction.

#### 3.2 Location

- .1 Lay out sign locations as per the Contract Drawings.
- .2 Sign location to be reviewed and approved by Departmental Representative prior to installation.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes
- .1 Excavation, Trenching and Backfilling to Section 31 23 33
  - .2 Aggregates to Section 31 05 16
- 1.2 Measurement for Payment
- .1 Payment for water main:
    - .1 Shall be full compensation for all work necessary and incidental for supply, installation by open cut or directional drill and testing of all water mains of pipe types and sizes indicated to lines, grades and cross section in accordance in the Drawings and as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: directional drill or open cut removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all water main piping and fittings, excluding valves and hydrants, supply, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment of this item shall be made at the unit price per lineal metre installed, as measured and accepted by the Departmental Representative.
  - .2 Payment for gate valves:
    - .1 Shall be full compensation for all work necessary and incidental for supply and installation of gate valves of types and sizes indicated in the Drawings and as directed by the Departmental Representative.
    - .2 Measurement for payment of this item shall be made at the unit price for each gate valve installed, as measured and accepted by the Departmental Representative.
  - .3 Payment for hydrant assemblies:
    - .1 Shall be full compensation for all work necessary and incidental for supply and installation of hydrant assemblies of types and sizes indicated in the Drawings and as directed by the Departmental Representative.
    - .2 Measurement for payment of this item shall be made at the unit price for each hydrant assembly installed, as measured and accepted by the Departmental Representative.
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- .4 Payment for water main testing:
    - .1 Shall be full compensation for all work necessary and incidental for the testing of all water mains as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: supply and installation of temporary test points; pressure testing, chlorinating, flushing and verification of all installed pipe; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities as accepted by the Departmental Representative.
  - .5 Payment for water main tie-ins:
    - .1 Shall be full compensation for all work necessary and incidental for the water main tie-ins (or connections) as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all water main piping and fittings, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; disinfection, swabbing of all installed pipe; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities for each tie-in location as accepted by the Departmental Representative.
- 1.3 References
- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
    - .1 ANSI/AWWA B300, Standard for Hypochlorites.
    - .2 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75mm through 1200mm), for Water.
    - .3 ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
    - .4 ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
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- .5 ANSI/AWWA C651, Disinfecting Water Mains.
  - .6 ANSI/AWWA C800, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
  - .7 ANSI/AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
  - .2 ASTM International
  - .3 American Water Works Association (AWWA) / Manual of Practice
    - .1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
  - .4 Canadian General Standards Board (CGSB)
  - .5 CSA International
- 1.4 Submittals
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit complete construction schedule for water mains. Include method for installation of water main.
  - .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .4 One week prior to start of laying pipe, Contractor to provide sieve analysis of the proposed bedding materials to the Department Representative for approval.
  - .5 Submit manufacturer's pipe certification
  - .6 Pipe certification to be on pipe. Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
    - .2 Pipe certification to be on pipe.
- 1.5 Installation Method
- .1 Contract Drawings indicate the pipe to be installed by both directional drill and open cut method.
  - .2 Contractor to install the pipe based on the method indicated on the Contract Drawings. The Contractor may change the method of installation at the discretion and approval of the Department Representative.
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- 1.6 Delivery and Storage
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Store materials off ground and in accordance with manufacturer's recommendations.
  - .4 Replace defective or damaged materials with new.
- 1.7 Scheduling of Work
- .1 Schedule Work to minimize interruptions to existing services.
  - .2 Submit schedule of expected interruptions to Department Representative for approval and adhere to interruption schedule as approved by Department Representative.
  - .3 Notify Department Representative a minimum of 48 h in advance of interruption in service.
  - .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
  - .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
  - .6 Provide "Out of Service" sign on hydrant not in use.
  - .7 Advise local police department of anticipated interference with movement of traffic.
- 1.8 Waste Management and Disposal
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.
  - .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- 1.9 Closeout Submittals
- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 77 00 - Closeout Submittals.
    - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

**PART 2 - PRODUCTS**

- 2.1 Pipe, Joints and Fittings
- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end.
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- .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.
  - .2 Ductile Iron fittings: to ANSI/AWWA C153/A21.53-06.
  - .2 High Density Polyethylene pressure pipe: to ANSI/AWWA C906-07
    - .1 Pressure class as indicated
    - .2 Iron Pipe Size equivalent outside diameter
    - .3 To be compatible with specified mechanical joint fittings and valves without special adapters
  - .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 and in accordance with manufacturer's recommendations.
  - .4 Polyethylene fittings:
    - .1 Fabricated HDPE mitred fittings to AWWA C906 suitable for pressure rating specified
    - .2 Moulded HDPE fittings to ASTM 3261 suitable for pressure rating specified and fusion to main pipe.
    - .3 Flanged joints to AWWA C906 flat faced stud end and loose hot-dip galvanized ductile iron (ASTM A536) backup ring drilling to ANSI B16.1, ANSI B16.5, or AWWA C207, class suitable for pressure rating specified.
  - 2.2 Valves and Valve Boxes
    - .1 Valves to open counter clockwise.
    - .2 Gate valves: to ANSI/AWWA C500, standard iron body, bronze mounted valves with non-rising stems, suitable for 1 Pa with mechanical, flanged, push-on, grooved type joints.
    - .3 Air and vacuum release valves: heavy duty combination air release valves employing direct acting kinetic principle.
      - .1 Fabricate valves of cast iron body and cover, with bronze trim, stainless steel floats with shock-proof synthetic seat suitable for 2 MPa working pressure.
      - .2 Valves to expel air at high rate during filling, at low rate during operation, and to admit air while line is being drained.
      - .3 Valve complete with surge check unit.
      - .4 Ends to be flanged to ANSI/AWWA C110/A21.10.
    - 4 Mainline valve boxes to be as specified on the Contract Drawings: telescoping, cast iron, top flange type service box.
      - .1 Valve box riser to be 150 mm diameter PVC DR35 or better.
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- 2.3 Tracer Wire
- .1 Direct Burial #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
    - .1 Copperhead Directional Drill Wire or approved equal
  - .2 Tracer Box shall include:
    - .1 Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
    - .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A126-B requirements.
    - .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
    - .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
    - .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
    - .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.
- 2.4 Valve Chambers
- .1 Concrete to Section 03 40 01 - Precast Concrete.
  - .2 Precast concrete sections to ASTM C478M. Cast ladder rungs integral with unit; field installation not permitted.
  - .3 Valve chamber frames and covers:
    - .1 Design and dimensions as indicated.
    - .2 Cover to be marked "WATER"/"EAU".
  - .4 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CAN/CSA-G30.18, hot-dipped galvanized after fabrication to CAN/CSA-G164. Rungs to be safety pattern.
- 2.5 Service Connections
- .1 Copper tubing: to ASTM B 88M type K, annealed.
  - .2 Polyethylene pressure pipe:
    - .1 To CSA-B137.1, type PE, series 160, ASTM F714, Type PE, series DR 11.
    - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE, series 250.
  - .3 Copper tubing joints: compression type suitable for 1 MPa working pressure.
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- .4 Polyethylene pipe joints: thermal butt fusion welded.
  - .5 Brass corporation stops: compression type having threads to ANSI/AWWA C800.
  - .6 Brass inverted key-type curb stops: compression type with drains.
    - .1 Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury.
    - .2 Top of cast iron box marked "WATER"/"EAU".
  - .7 Polyethylene tapping tees or multi-saddle tees: for Polyethylene pipe. Tees to be socket fused to pipe.
  - .8 Service connections for PVC pipe:
    - .1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
    - .2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.
  - .9 Bronze type service clamps: for PVC pipe service connections.
    - .1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
    - .2 Clamps to be tapped with threads to ANSI/AWWA C800.
  - .10 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.
- 2.6 Yard Hydrants
- .1 Yard Hydrants: Terminal City self-draining stand pipe, factory assembled unit:
    - .1 Hydrants to open threads to local standard, Provide metal caps and chains.
    - .2 Yard Hydrant to be manufactured with bronze operating and draining components.
    - .3 The stuffing box and draining mechanism to have "O" ring rubber gaskets for sealing purposes.
    - .4 Polyurethane anti-score seating material is used for the valve disc facing.
    - .5 Provide key operated gate valve located 1m from hydrant.
    - .6 Depth of bury 1.2 m.
  - .2 Hydrant paint: exterior enamel to CAN/CGSB-1.88,MPI #96.
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- .1 Hydrant Body to be red.
  - .2 Caps and ports to be white.
- 2.6 Pipe Bedding and Surround Material .1 Pipe bedding and surround in accordance with Section 31 05 16 – Aggregates.
- 2.7 Backfill .1 Backfill in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- 2.8 Pipe Disinfection .1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.
- PART 3 - EXECUTION**
- 3.1 Preparation .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
- .1 Inspect materials for defects to approval of the Department Representative.
  - .2 Remove defective materials from site as directed by Department Representative.
- 3.2 Trenching .1 Do trenching work in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1.0 m from finished grade or as indicated.
  - .3 Trench alignment and depth require Department Representative approval prior to placing bedding material and pipe.
- 3.3 Granular Bedding .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150mm below bottom of pipe.
- .2 Do not place material in frozen condition.
  - .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
  - .4 Shape transverse depressions in bedding as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
  - .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
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**3.4 Pipe Installation**

- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .2 Join pipes in accordance with manufacturer's recommendations. Butt-fuse high density polyethylene in strict accordance with manufacturer's instruction by manufacturer or by manufacturer's trained personnel.
  - .3 Bevel or taper ends of PVC pipe to match fittings.
  - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .5 Lay pipes on prepared bed, true to line and grade.
    - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
    - .2 Take up and replace defective pipe.
    - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
  - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
  - .7 Do not exceed one half of permissible deflection at joints as recommended by pipe manufacturer. For HDPE pipe cold bending allowed to a minimum radius of 50 times nominal pipe size without special fittings.
  - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
    - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .9 Position and join pipes with equipment and methods approved by Department Representative.
  - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
  - .11 Align pipes before jointing.
  - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
    - .1 Remove disturbed or contaminated gaskets.
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- .2 Clean, lubricate and replace before jointing is attempted again.
  - .14 Complete each joint before laying next length of pipe.
  - .15 Minimize deflection after joint has been made.
  - .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
  - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Department Representative.
  - .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
  - .20 Install tracer wire along entire length of watermain with Test boxes located at maximum 1000m separation.
  - .21 Do not lay pipe on frozen bedding.
  - .22 Do hydrostatic and leakage test and have results approved by the Department Representative before surrounding and covering joints and fittings with granular material.
  - .23 Backfill remainder of trench. Ensure all polyethylene pipe is at temperature of surrounding soil when it is backfilled and compacted.
- 3.5 Valve Installation
- .1 Install valves to manufacturer's recommendations at locations as indicated.
- 3.6 Valve Chambers
- .1 Use precast units as approved by the Department Representative.
  - .2 Construct units as indicated, plumb and centered over valve nut, true to alignment and grade, and not resting on pipe.
  - .3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.
  - .4 Plug lifting holes with precast concrete plugs set in cement mortar.
  - .5 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
  - .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.
- 3.7 Service Connections
- .1 Terminate building water service 1 m outside building wall or as indicated opposite point of connection to main. Locate point of connection in advance and advise Department Representative.
  - .2 Cap or seal end of pipe and place temporary marker to locate pipe end.
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- .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
- .3 Construct service connections at right angles to water main unless otherwise directed.
- .4 Tappings on ductile iron, or PVC-C900 pipe, may be threaded without service clamps.
  - .1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.
  - .2 Tappings PVC-C900 pipe to conform to following:

Pipe Diameter	Max Tap without Clamp	Max Tap with Clamp
100 mm	20 mm	25 mm
150 mm	20 mm	40 mm
200 mm	25 mm	50 mm
250 mm	25 mm	50 mm
300 mm	40 mm	75 mm

- .5 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.
  - .6 Tappings for PE pipe: PE tapping tees or multi-saddle tees.
  - .7 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
  - .8 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
  - .9 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.
  - .10 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
  - .11 Leave corporation stop valves fully open.
  - .12 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
  - .13 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
  - .14 Install curb stop with corporation box on services NPS 2 or less in diameter.
    - .1 Equip larger services with gate valve and cast iron box.
    - .2 Set box plumb over stop and adjust top flush with final grade elevation.
    - .3 Leave curb stop valves fully closed.
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- .15 Place temporary location marker at ends of plugged or capped unconnected water lines.
    - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
    - .2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.
  
  - 3.8 Yard Hydrants
    - .1 Install yard hydrants at locations as indicated.
    - .2 Set hydrants plumb, with hose outlets parallel with edge of pavement with outlet facing roadway.
    - .3 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
    - .4 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
    - .5 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.
  
  - 3.9 Thrust Blocks and Restrained Joints
    - .1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Department Representative.
    - .2 Keep joints and couplings free of concrete.
    - .3 Do not backfill over concrete within 24 hours after placing.
    - .4 For restrained joints: only use restrained joints approved by Department Representative
  
  - 3.10 Hydrostatic and Leakage Testing
    - .1 Perform pressure and leakage testing of High Density Polyethylene (HDPE) piping to AWWA M55; no leakage allowed.
    - .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
    - .3 Notify Department Representative at least 24 hours in advance of proposed tests.
      - .1 Perform tests in presence of Department Representative.
    - .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
    - .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Department Representative.
    - .6 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes between joints
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with approved granular material placed as directed by Department Representative.

- .7 Leave hydrants, valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1035 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hours.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Leakage defined as the amount of water supplied in order to maintain test pressure for 2 hours.
- .18 Locate and repair defects if leakage is greater than amount specified.
- .19 Repeat test until leakage is within specified allowance for full length of water main.

### 3.11 Pipe Surround

- .1 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
  - .5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D 698.
  - .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.
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- 3.12 Backfill .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under roadways and pathways, compact backfill to at least 95% maximum density to ASTM D 698.

- 3.14 Flushing and Disinfection .1 Flushing and disinfecting operations: witnessed by Department Representative.
- .1 Notify Department Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear. The contractor shall supply all water for flushing and testing.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
150 mm and below	38
200 mm	75
250 mm	115
300 mm	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Department Representative approval, introduce strong solution of chlorine as approved by Department Representative into water main and ensure that it is distributed throughout entire system.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine application to be close to point of filling water main and to occur at same time.
- .9 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .10 Flush line to remove chlorine solution after 24 hours.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
- .1 Take samples daily for minimum of two days.
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- .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .3 Specialist contractor to submit certified copy of test results.
- .13 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .14 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- 3.15 Surface Restoration
  - .1 After installing and backfilling over water mains, restore surface as per the Contract Drawings as approved by the Department Representative.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Section Includes
- .1 Excavation, Trenching and Backfilling to Section 31 23 33
  - .2 Aggregates to Section 31 05 16
- 1.2 Measurement for Payment
- .1 Payment for sewer force main:
    - .1 Shall be full compensation for all work necessary and incidental for supply, installation by open cut or directional drill and testing of all sewer force mains of pipe types and sizes indicated to lines, grades and cross section in accordance in the Drawings and as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: directional drill or open cut by removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all sewer force main piping and fittings; supply, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment of this item shall be made at the unit price per lineal metre installed, as measured and accepted by the Departmental Representative.
  - .2 Payment for sewer force main testing:
    - .1 Shall be full compensation for all work necessary and incidental for the testing of all sewer force mains as directed by the Departmental Representative.
    - .2 The prices bid shall include, but not be limited to: supply and installation of temporary test points; pressure testing and verification of all installed pipe; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
    - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities as accepted by the Departmental Representative.
  - .3 Payment for sewer force main tie-ins:
    - .1 Shall be full compensation for all work necessary and incidental for the sewer force main tie-ins (or connections) as directed by the Departmental Representative.
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- .2 The prices bid shall include, but not be limited to: removal of excavated material and piping as required; offsite disposal of surplus materials; temporary shoring as required; supply and installation of all main piping and fittings, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material to underside of road structure; and all other work and materials necessary to complete this portion of the Work to provide a complete system to the satisfaction of the Departmental Representative.
  - .3 Measurement for payment for this item shall be at the lump sum unit price tendered in the Schedule of Prices and Quantities for each tie-in location as accepted by the Departmental Representative.
- 1.3 References
- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
    - .1 ANSI/AWWA B300, Standard for Hypochlorites.
    - .2 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75mm through 1200mm), for Water.
    - .10 ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
    - .20 ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
    - .24 ANSI/AWWA C651, Disinfecting Water Mains.
    - .25 ANSI/AWWA C800, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
    - .26 ANSI/AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
  - .2 ASTM International.
  - .3 American Water Works Association (AWWA) / Manual of Practice
    - .1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
  - .5 Canadian General Standards Board (CGSB).
  - .6 CSA International.
- 1.4 Submittals
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit complete construction schedule for sanitary sewer force mains.
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accordance with Waste Management Plan.

- 1.9 Closeout Submittals .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, maintenance and operating instructions in accordance with Section 01 77 00 - Closeout Submittals.
- .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes and valve chambers.

## PART 2 - PRODUCTS

- 2.1 Pipe, Joints and Fittings .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end
- .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.
- .2 Ductile Iron fittings: to ANSI/AWWA C153/A21.53-06.
- .2 High Density Polyethylene pressure pipe: to ANSI/AWWA C906-07
- .1 Pressure class as indicated
- .2 Iron Pipe Size equivalent outside diameter
- .3 To be compatible with specified mechanical joint fittings and valves without special adapters
- .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 and in accordance with manufacturer's recommendations.
- .4 Polyethylene fittings:
- .1 Fabricated HDPE mitred fittings to AWWA C906 suitable for pressure rating specified
- .2 Moulded HDPE fittings to ASTM 3261 suitable for pressure rating specified and fusion to main pipe.
- .3 Flanged joints to AWWA C906 flat faced stud end and loose hot-dip galvanized ductile iron (ASTM A536) backup ring drilling to ANSI B16.1, ANSI B16.5, or AWWA C207, class suitable for pressure rating specified.
- 2.2 Tracer Wire .1 Direct Burial #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
- .1 Copperhead Directional Drill Wire or approved equal
- .2 Tracer Box shall include:
- .1 Tube material shall be of high grade ABS, or equivalent rigid
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- plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
- .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A126-B requirements.
- .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
- .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
- .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
- .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.
- 2.3 Pipe Bedding and Surround .1 Pipe bedding and surround in accordance with Section 31 05 16 –  
Material Aggregates.
- 2.4 Backfill .1 Backfill in accordance with Section 31 23 33 - Excavating, Trenching  
and Backfilling.
- PART 3 - EXECUTION**
- 3.1 Preparation .1 Clean pipes, fittings, valves and appurtenances of accumulated debris  
and water before installation.
- .1 Inspect materials for defects to approval of the Department  
Representative.
- .2 Remove defective materials from site as directed by  
Department Representative.
- 3.2 Trenching .1 Do trenching work in accordance with Section 31 23 33 - Excavating  
Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1.0 m from  
finished grade or as indicated.
- .3 Trench alignment and depth require Department Representative  
approval prior to placing bedding material and pipe.
- 3.3 Granular Bedding .1 Place granular bedding material in uniform layers not exceeding 150  
mm compacted thickness to depth of 150mm below bottom of pipe.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface
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- for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
  - .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
- 3.4 Pipe Installation
- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .2 Join pipes in accordance with manufacturer's recommendations. Butt-fuse high density polyethylene in strict accordance with manufacturer's instruction by manufacturer or by manufacturer's trained personnel.
  - .3 Bevel or taper ends of PVC pipe to match fittings.
  - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .5 Lay pipes on prepared bed, true to line and grade.
    - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
    - .2 Take up and replace defective pipe.
    - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
  - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
  - .7 Do not exceed one half of permissible deflection at joints as recommended by pipe manufacturer. For HDPE pipe cold bending allowed to a minimum radius of 50 times nominal pipe size without special fittings.
  - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
    - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .9 Position and join pipes with equipment and methods approved by Department Representative.
  - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
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- .11 Align pipes before jointing.
  - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
    - .1 Remove disturbed or contaminated gaskets.
    - .2 Clean, lubricate and replace before jointing is attempted again.
  - .14 Complete each joint before laying next length of pipe.
  - .15 Minimize deflection after joint has been made.
  - .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
  - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Department Representative.
  - .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
  - .20 Install tracer wire along entire length of main with Test boxes located at maximum 1000m separation.
  - .21 Do not lay pipe on frozen bedding.
  - .22 Do hydrostatic and leakage test and have results approved by the Department Representative before surrounding and covering joints and fittings with granular material.
  - .23 Backfill remainder of trench. Ensure all polyethylene pipe is at temperature of surrounding soil when it is backfilled and compacted.
- 3.5 Valve Installation
- .1 Install valves to manufacturer's recommendations at locations as indicated.
- 3.6 Valve Chambers
- .1 Use precast units as approved by the Department Representative.
  - .2 Construct units as indicated, plumb and centred over valve nut, true to alignment and grade, and not resting on pipe.
  - .3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.
  - .4 Plug lifting holes with precast concrete plugs set in cement mortar.
  - .5 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
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- .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.
  - 3.7 Service Connections
    - .1 Terminate building sewer service 1 m outside building wall or as indicated opposite point of connection to main. Locate point of connection in advance and advise Department Representative.
      - .2 Cap or seal end of pipe and place temporary marker to locate pipe end.
    - .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of sewer force main.
    - .3 Construct service connections at right angles to sewer main unless otherwise directed.
    - .4 Tappings for PE pipe: PE tapping tees or multi-saddle tees.
    - .5 Place temporary location marker at ends of plugged or capped unconnected service lines.
    - .6 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
    - .7 Paint exposed portion of stake red with designation "SEWER SERVICE LINE" in black.
  - 3.8 Thrust Blocks and Restrained Joints
    - .1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Department Representative.
    - .3 Keep joints and couplings free of concrete.
    - .4 Do not backfill over concrete within 24 hours after placing.
    - .5 For restrained joints: only use restrained joints approved by Department Representative
  - 3.9 Hydrostatic and Leakage Testing
    - .1 Perform pressure and leakage testing of High Density Polyethylene (HDPE) piping to AWWA M55; no leakage allowed.
    - .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
    - .3 Notify Department Representative at least 24 hours in advance of proposed tests.
      - .1 Perform tests in presence of Department Representative.
    - .4 Where section of system is provided with concrete thrust blocks, conduct tests at least [5] days after placing concrete or [2] days if high early strength concrete is used.
    - .5 Test pipeline in sections not exceeding 365 m in length, unless
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otherwise authorized by the Department Representative.

- .6 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Department Representative.
- .7 Leave valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1035 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hours.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Leakage defined as the amount of water supplied in order to maintain test pressure for 2 hours.
- .18 Locate and repair defects if leakage is greater than amount specified.
- .19 Repeat test until leakage is within specified allowance for full length of main.

### 3.10 Pipe Surround

- .1 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
  - .5 Compact each layer from pipe invert to mid height of pipe to at least
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- 95% maximum density to ASTM D 698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.
- 3.11 Backfill
- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under roadways and pathways, compact backfill to at least 95% maximum density to ASTM D 698.
- 3.12 Surface Restoration
- .1 After installing and backfilling over mains, restore surface as per the Contract Drawings as approved by the Department Representative.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 General .1 The intent of this specification to supplement Section 33 11 01- Waterworks and Section 33 34 00 – Sanitary Sewer Force Mains.
- .2 This section defines the acceptable methods and materials for installing fibre optic conduit, sewage forcemain and water mains by the horizontal directional drilling method and the requirements for high density polyethylene (HDPE) pipe installed by directional drilling or in open cut trenches as indicated.
- 1.2 Basis of Payment .1 No measurement for payment will be made under this Section.
- 1.3 References .1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM F1962-99, Standard Guide for Use of Max-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.
- 1.4 Installation Plan Submission .1 At least 7 days prior to mobilizing equipment Contractor shall submit his detailed installation plan to the Department Representative. The plan shall include a detailed plan and profile of the bores and be plotted at a scale no smaller than 1:500.
- .2 The plan shall be signed and sealed by a Professional Engineer (P.Eng) experienced with the installation of pipeline with horizontal directional drilling and registered in the Province of British Columbia.
- .3 The plan shall also include a listing of major equipment and supervisory personnel and a description of the methods to be used.
- 1.5 Variations in Plan or Profile .1 The Contractor may request changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points. Proposed changes shall be submitted in writing to the Engineer and receive approval of the Engineer prior to construction.
- 1.6 Alignment .1 The proposed plan and profile installation locations are based on alignments to accommodate acquired easements, to avoid obstructions, to accommodate air release and flowout, and to properly maintain operation flow velocities.
- 1.7 Qualifications .1 Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least five (5) years' experience in this work. Furthermore, the Contractor shall have installed directionally drilled pipe at least as large as 300mm in diameter, and have performed installations at least 600m in length.
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**PART 2 - PRODUCTS**

- 2.1 General .1 High density polyethylene pipe to AWWA C906 with pressure class as indicated shall be used in HDD installations. All piping system components shall be the products of one manufacturer and shall conform to the latest edition of ASTM D1248, ASTM D3350, and ASTM F714.
- 2.2 Piping and Bends .1 Piping and Bends shall be extruded from a polyethylene compound and shall conform to the following requirements:
- .1 The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 4710 material with a cell classification of 335434C, or better.
  - .2 The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than two percent.
  - .3 The maximum allowable hoop stress shall be 5500KPa at 23°C.
  - .4 The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.
  - .5 The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as indicated.
  - .6 Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.
  - .7 Water pipe exterior shall be blue in color or contain blue striping.
- 2.3 Tracer Wire .1 Direct Burial #12 AWG Solid, steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
- .2 Tracer Box shall be included:
- .1 Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
  - .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A-126-B requirements.
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- .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
- .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
- .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
- .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.

### PART 3 - EXECUTION

- 3.1 General Procedures
    - .1 All polyethylene pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expense for the representative shall be paid for by the Contractor.
  - 3.2 Transportation
    - .1 Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged.
  - 3.3 Storage
    - .1 Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe.
    - .2 Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature condition.
    - .3 Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
  - 3.4 Handling Pipe
    - .1 The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects.
    - .2 Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used.
    - .3 Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints.
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- .4 Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.
  - .5 The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section. Waterproof nightcaps of approved design may be used but they shall also be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose. The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.
  - .6 Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.
- 3.5 General Installation
- .1 The Contractor shall install the pipelines by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.
  - .2 Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these Specifications.
  - .3 The Contractor shall prepare and submit a plan to the Department Representative for approval for insertion of the HDPE pipe into the opened bore hole. This plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.
  - .4 The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.
- 3.6 Joining Pipe Sections
- .1 Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.
  - .2 Pipes shall be joined to one another by means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.
  - .3 Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:
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- .1 A polyethylene “stub end” shall be thermally butt-fused to the ends of the pipe.
  - .2 Provide ASTM A240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.
  - .3 Stainless Steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after 4 hours.
- 3.7 Testing
- .1 The pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After this test, the water will be removed with pigs. Erosion prevention and dechlorination procedures will be used during removal and discharge of the water.
  - .2 Before pipe is filled with water, pipe bedding, concreting of all valves and fittings and backfilling to be completed as required in this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressure tests. Submit pipeline to a test of 1.5 x working pressure applied at the highest elevation in each section, with a minimum of 1380 kPa applied at lowest point of test section. Ensure that test pressure does not exceed pipe or thrust restraint design pressures. Maximum allowable leakage rate at test pressure to not exceed 1.25 litres per millimeter diameter of pipe per kilometer per 24 hour period. Minimum duration of test period to be 2 hours. Maximum test pressures should not exceed those specified in CSA B137.3 – Table 9.
- 3.8 Tolerances
- .1 Pipe installed by the directional drilled method must be located in plan as shown on the Drawings, and must be no shallower than shown on the Drawings unless otherwise approved.
  - .2 The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 10 meters. This “as built” plan and profile shall be updated as the pilot bore is advanced.
  - .3 The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure.
  - .4 The Contractor shall grant the Department Representative access to all data and readout pertaining to the position of the bore head and the fluid pressures and flows. When requested, the Contractor shall provide explanations of this position monitoring and steering equipment.
  - .5 The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position
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monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Department Representative.

- .6 Each exit point shall be located as shown with an over-length tolerance of 3 meters for directional drills of 300 linear meters or less and 12 meters for directional drills of greater than 300 linear meters and an alignment tolerance of 500mm horizontal (left/right) and 200mm vertical with due consideration of the position of the other exit points and the required permanent easement.
- .7 The alignment of each pilot bore must be approved by the Department Representative before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Department Representative may, at his option, require a new pilot boring to be made.
- .8 After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dens, buckles, gouges, and internal obstructions) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of 2.0m or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of 2.0m.

### 3.9 Ream and Pullback

- .1 Reaming: Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.
  - .2 Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.
  - .3 Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.
  - .4 The lead end of the pipe shall be closed during the pullback operation.
  - .5 Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent overstressing or buckling during the pullback operation. Such support/rollers shall be spaced at a maximum of 18m on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before
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pulling operations resume.

- .6 The contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.
- 3.10 Handling Drilling Fluids and Cuttings .1 During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into any waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into any waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.
- .2 Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the road ditch or any waterway.
- .3 The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these Specifications.
- .4 To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.
- .5 The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.
- .6 As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.
- 3.11 Drilling Operations .1 The Contractor shall prepare a plan to be submitted for Department Representative approval which describes the noise reduction program, solids control plant, pilot hole drilling procedure, the reaming operation, and the pullback procedure.
- .2 All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling.
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- .3 All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.
  - .4 Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 days prior to start and certified as double white band or better shall be used.
  - .5 A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the construction drawings.
  - .6 The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 10m interval). Deviations from the acceptable tolerances described in the Specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bores define the minimum depth and radius of curvature. The Contractor shall maintain and provide to the Engineer, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.
  - .7 Between the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 3 meters wide and 12 meters long centered on the planned exit point.
  - .8 During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.
  - .9 Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.
- 3.12 Environmental Provisions .1 The Horizontal Directional Drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent ditches or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste.
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- All excavated pits used in the drilling operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.
- .2 The Contractor shall visit the site in advance of tender and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.
- .3 The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.
- .4 Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.
- .5 Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.
- .6 Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50% of weight.
- .7 Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.
- 3.13 Emergency Frac-Out Plan .1 The contract shall prepare an emergency frac-Out plan and submit to the Department Representative 1 week prior to the start of construction. The contractor shall include the following requirements.
- .1 Keep all material and equipment needed to contain and clean up drilling mud releases on site and readily accessible in the event of a frac-out.
- .2 In the event of a Frac-Out, implements measures to stop work, contain the drilling mud and prevent its further migration into the watercourse and notify all applicable authorities, including the closest DFO office in the area. Prioritize cleanup activities
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- relative to the risk of potential harm and dispose of the drilling mud in a manner that prevents reentry into the watercourse,
- .3 Ensures clean up measures do not result in greater damage to the banks and watercourse than from leaving the drilling mud in place.
  - .4 In the event of a frac-out contact the Departmental Representative, Environmental Monitor and Parks Representative.
  - .5 Stabilize any waste materials removed from the work site to prevent them from entering a watercourse.
  - .6 Remediation of any disturbed areas will be directed by Environmental Monitor at the Contractor's cost.
- 3.14 Inspection and Cleanup .1 It is necessary to minimize any residual stresses or strains remaining in the pipe following the installation, due to the imposed pulling forces and potential thermal expansion or contraction. Thus, the pipe should be allowed to achieve mechanical and thermal equilibrium with its surroundings prior to cutting the pipe at either end. Premature cutting of the pipe may allow the ends to shrink back into the hole. The pipe may be cut after it has been verified that there has been insignificant movement at the pipe entry end and negligible residual tensile load at the drill rig end.
- .2 If any fluid or slurry was allowed to enter the pipe to serve as ballast, the fluid must be purged and the pipe thoroughly flushed and cleaned.
- 3.15 Surface Restoration .1 After installing and backfilling, restore surface to original condition as approved by the Department Representative.

**END OF SECTION**

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**PART 1 - GENERAL**

- 1.1 Measurement for Payment .1 The unit prices bid for this item shall be full compensation for all work necessary and incidental for supply and installation of all pipe culverts of pipe types and sizes indicated to lines, grades and cross section in accordance with the Drawings and as directed by the Departmental Representative.
- .2 The prices bid shall include, but not be limited to: excavation; disposal of surplus materials; temporary shoring as required; supply and installation of pipe culverts, including couplings, precast concrete endwalls; dewatering; supply, placement and compaction of bedding and backfill materials; compaction testing of placed bedding and granular material; reinstatement; cleaning; and all other work and materials incidental and necessary to complete the Work to provide a complete and functional system in accordance with the Drawings and to the satisfaction of the Departmental Representative.
- .3 Measurement for payment shall be all-inclusive for all respective pipework including fittings, endwalls and appurtenances and shall be paid at the unit rates tendered in the Schedule of Prices and Quantities and accepted by the Departmental Representative.
- 1.2 References .1 ASTM International
- .1 ASTM D2412, pipe stiffness.
- .2 ASTM F477, gaskets.
- .2 CSA International
- .1 CSA B182.8, HDPE pipe.
- 1.3 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .1 Store materials in accordance with manufacturer's recommendations.
- .2 Store and protect pipe and pipe material from damage.
- .3 Replace defective or damaged materials with new.
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**PART 2 – PRODUCTS**

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| 2.1 High Density Polyethylene       | .1 | Exterior pipe corrugation to be embossed with stiffness ratings as required by CSA B182.8.              |
|                                     | .2 | Pipe to have factory assembled spigot gaskets and integral bell joint features certified to CSA B182.8. |
|                                     | .3 | Pipe to have minimum stiffness of 320 kPa at 5% deflection, when tested in accordance with ASTM D241.   |
|                                     | .4 | Gaskets to meet requirements of ASTM F477.  |
| 2.3 Granular Bedding and Backfiller | .1 | Refer to Section 31 05 16 – Aggregates of specification for bedding and backfill materials.             |

**PART 3 - EXECUTION**

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|-----------------|----|---|
| 3.1 Examination | .1 | Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions. |
|                 | .1 | Visually inspect substrate in presence of Departmental Representative.  |
|                 | .2 | Inform Departmental Representative of unacceptable conditions immediately upon discovery.   |
|                 | .3 | Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.  |
| 3.2 Preparation | .1 | Temporary Erosion and Sedimentation Control:  |
|                 | .1 | Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent surroundings.  |
|                 | .2 | Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.   |
|                 | .3 | Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.   |
| 3.3 Trenching   | .1 | Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.  |
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- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.
  - 3.4 Bedding
    - .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
    - .2 Place 100 mm minimum thickness of approved, compacted granular bedding material on bottom of excavation.
    - .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
    - .4 Place bedding in unfrozen condition.
  - 3.5 Laying Pipe Culverts
    - .1 Begin pipe placing at downstream end.
    - .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
    - .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
    - .4 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.
  - 3.6 Joints
    - .1 Install rubber gasket joints in accordance with manufacturer's written recommendations.
    - .2 Ensure that spigot ends are fully entered into bell ends.
  - 3.7 Backfilling
    - .1 Backfill around and over culverts as indicated or as directed by Departmental Representative.
    - .2 Place granular backfill material in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
    - .3 Compact each layer to 95% maximum density to ASTM D698 taking special care to obtain required density under haunches.
    - .4 Protect installed culvert with minimum 600mm cover of compacted fill before heavy equipment is permitted to cross.
    - .5 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
    - .6 Place backfill in unfrozen condition.
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|--------------|----|--|
| 3.8 Fluming  | .1 | Assemble and install fluming as indicated.           |
|              | .2 | Set top edges of fluming flush with side slope.      |
| 3.9 Endwalls | .1 | Construct endwalls as shown on the Contract Drawings |

**END OF SECTION**

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**PWGSC**

Pacific Traverse Trail Clearing  
Pacific Rim National Park Reserve, BC  
Project No. R.089036.001

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**APPENDIX A**

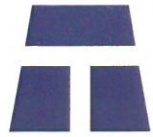
# **Appendix A**

## **Wick Road and Kwisitis Parking Lot Upgrades**

### **Geotechnical Investigation**

Thurber Engineering Ltd.  
January 13, 2017

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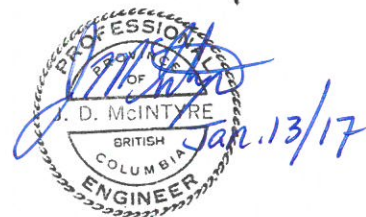
**WICK ROAD AND KWISITIS PARKING LOT UPGRADES  
GEOTECHNICAL INVESTIGATION**

**Report**

to

**Parsons**

Stephen Bean, M.Eng., P. Eng.  
Review Engineer



Date: January 13, 2017  
File: 12047

Jay McIntyre, M. A.Sc., P.Eng.  
Project Engineer



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## **1. INTRODUCTION**

This report presents the results of a multi-phase geotechnical investigation carried out by Thurber Engineering Ltd. (Thurber) for the proposed rehabilitation of roads and parking lots near Wickaninnish Beach within the Pacific Rim National Park at Ucluelet, BC.

Thurber's scope of work was outlined in our proposal letter to Parsons dated March 29, 2016. Authorization to proceed with the work was received in the form of Sub-Consultant Agreement No. 602029 (BM3446), dated May 1, 2016. The scope of work was subsequently revised on November 8, 2016 when authorization was received to complete supplemental test pits along the S-curve section of Wick Road, where a road re-alignment was proposed.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

## **2. PROJECT UNDERSTANDING**

Extensive upgrading of existing roadways and parking lots within the Pacific Rim National Park are proposed. The following upgrades are anticipated, although we understand that not all will proceed simultaneously:

- Rehabilitation of Wick Road between Florencia Bay Access and Ocean Terrace Road;
- Re-alignment of the S-curve section of Wick Road between Ocean Terrace Road and Wickaninnish Beach Access Road;
- Pavement and drainage upgrades at the Kwisis Visitor Centre parking lot;
- Pavement upgrades at three parking lots along Wickaninnish Beach Access Road.
- A new asphalt parking lot at Florencia Bay beach access;
- Possible upgrades/widening of Florencia Bay Access Road.

In addition to the above noted road and parking lot upgrades, we understand that sections of the upgraded Wick Road alignment will incorporate a new paved multi-use trail. This trail will be contiguous with the road, with the pavement surface being separated by concrete no-post barrier.

## **3. INVESTIGATION METHODOLOGY**

Geotechnical field investigations were completed in the following phases:

- Engineering Reconnaissance Visit
- Drilling Investigation
- Supplement Test Pits along S-curve Section

These phases are discussed in more detail below.

### **3.1 Reconnaissance Visit**

A reconnaissance site visit made by a senior geotechnical engineer on May 27, 2016 with Parsons personnel in attendance. The objectives of the visit were to review the current pavement conditions, conduct a preliminary visual assessment of slope stability along Wick Road, and to select preliminary test hole locations.

### **3.2 Drilling Investigation**

The second investigation phase consisted of drilled test holes and was completed using a truck-mounted auger drill rig supplied and operated by Drillwell Enterprises of Duncan, BC. A total of 23 drill holes (TH16-1 to -23) were completed between June 1 and 3, 2016. The majority of the test holes were shallow and extended 1.5 m to 3 m below grade. Test holes TH16-5 to -7 were completed on the sloping section of Wick Road between Ocean Terrace Road and the intersection of the Wickaninnish Beach Access Road. These test holes were drilled from 6.1 m to 15.3 m below the surface of the road. The approximate locations of test holes are shown on Drawing Nos. 12047-1 to -5, included in Appendix A. These locations were determined in the field using a hand-held GPS device.

Prior to commencing the drilling work, Thurber carried out the BC One Call process to identify potential buried and overhead services that may impact the investigations. A private utility locate contractor was then retained to check each proposed test hole location for underground services. Parks Canada personnel were also consulted as to the potential location of buried services within the Park.

Dynamic cone penetration tests (DCPT) were conducted at selected holes to estimate the density of the granular soils. A single standpipe piezometer was installed at TH16-5 to allow subsequent monitoring of groundwater levels.

Test holes were backfilled with drill cuttings. An asphalt “cold patch” was installed at the ground surface for those holes drilled through existing asphalt pavement. Although efforts were made to compact the backfill materials, it is not uncommon for the backfill materials to consolidate over time resulting in localized pot holes to develop at drill hole locations. Future maintenance may be required to correct for this.

Disturbed soil samples were obtained at selected depths from the augers and were returned to our Victoria laboratory for visual identification and determination of natural moisture contents.

Grain size analyses were completed on selected samples of the existing pavement structure fill materials. The results of the drilling and laboratory testing undertaken for this study are summarized on the test hole logs in Appendix B. An explanation of the symbols and terms used to describe the test hole logs, and a description of the Modified Unified Soils Classification system are also provided therein.

An environmental assessment of the potential for contaminated soils was not included in Thurber's scope for this investigation; however, soil samples were inspected for signs of possible contamination, including staining and/or hydrocarbon odour.

### **3.3 Supplemental Test Pits**

A supplemental test pit program was completed to provide additional soils data along the upslope side of the S-curve section of Wick Road. This information was needed to evaluate options for retaining or re-grading the slope above the re-aligned road. On November 22, 2016, three test pits (TP16-1 to -3) were completed in the forested area upslope of the existing road using a Deere 135G tracked excavator operated by Gibson Bros. Contracting of Tofino. The test pit locations are shown on Drawing No. 12047-5, included in Appendix A. The test pit locations were carefully selected in consultation with Parks Canada staff to minimize disturbance to existing vegetation.

The observed soil and groundwater conditions were logged by a Thurber geotechnical engineer. As the excavations proceeded, a hand-held field vane tester was used to evaluate the in-situ shear strength of clayey soils. Representative disturbed samples of the soils encountered were collected from the excavator bucket at regular intervals and returned to our laboratory for testing. Routine visual classification and water content determination were completed on all samples, and Atterberg limits were completed on a selected clay sample from TP16-2. The laboratory test results are summarized on the test pit logs in Appendix B.

The test pits were backfilled with the excavation spoils and packed with the excavator bucket. Topsoil and forest litter were replaced over the disturbed areas to promote the restoration of vegetation. Mats of wood shavings on a fine monofilament mesh (similar to coconut matting) were also installed in the disturbed areas upslope of the existing stormwater ditch to reduce runoff erosion. The restoration of the disturbed areas was completed in consultation with on-site Parks Canada staff.

#### 4. GROUND CONDITIONS

The following subsections summarize the ground conditions encountered across the various areas of the project site. Refer to the test hole and test pit logs in Appendix B for further details concerning the stratigraphy encountered.

##### 4.1 Wick Road

##### 4.1.1 Pavement Structure

A total of seven test holes (TH16-1 to -7) and three test pits (TP16-1 to -3) were completed along Wick Road as shown on the attached Drawing Nos. 12047-3 to -5. Test holes TH16-1 to -4 were completed on the upper section of the road between the Shorepine Bog Trail access and the Ocean Terrace Road intersection. This section of the road alignment is generally straight and flat, with localized dips and rises. Test holes TH16-5 to -7 were completed on the section of the road that slopes down from Ocean Terrace Road to the intersection with the Wickaninnish Beach Access Road.

Table 4.1 following summarizes the pavement structure fill encountered along Wick Road, and also notes the depth to groundwater, if encountered. As noted in the table, the asphalt thickness along Wick Road varied from 50 mm to 100 mm, with an average thickness of about 78 mm. The underlying granular pavement structure fill consists of “pit run” sand and gravel and is generally 500 mm to 550 mm in thickness.

Table 4.1 – Summary of Pavement Structure Fill for Wick Road

Test Hole No.	Drilled Depth (m)	Asphalt Thickness (mm)	Pavement Structure Fill Thickness (mm)	Depth to Groundwater (m)	Pavement Structure Fill Description
16-1	3.0	100	500	n/a	SAND & GRAVEL, trace to some silt
16-2	3.0	75	525	n/a	SAND & GRAVEL
16-3	3.0	75	525	2.1	SAND & GRAVEL, trace silt
16-4	3.0	75	525	2.1	SAND & GRAVEL, trace silt
16-5	15.2	100	500	13.0	SAND & GRAVEL, trace to some silt
16-6	6.1	75	375	n/a	SAND & GRAVEL, trace silt
16-7	6.1	50	550	n/a	Sandy GRAVEL, trace to some silt

#### 4.1.2 Subgrade Soils

At test holes TH16-1 to -4 on upper Wick Road, the pavement structure was directly underlain by a zone of loose/soft subgrade soils, ranging in thickness from approximately 600 mm to 900 mm. At TH16-1, the loose zone consists of moist to wet, silty sand with varying amounts of gravel, while at TH16-2 a layer of soft sandy silt to clayey silt was encountered. Soft subgrade soils were also encountered at TH16-3 and -4, but at these locations the upper 300 mm of the zone consists of dark brown to black organic silt with varying sand and gravel content.

These upper loose/soft subgrade soils transition to denser granular soils with depth. At TH16-1 and -2, compact to dense sand with trace to some silt and varying gravel content was encountered below 1.5 m depth. At TH16-3 and -4 the soft subgrade soils transition to a dense to very dense sandy gravel deposit with varying silt content (trace to silty).

For the sloping S-curve section of Wick Road (TH16-5 to -7), the subgrade soils consist primarily of firm silty clay soils. However, at TH16-5, a 300 mm thick layer of dark brown to black clayey silt with organics and wood fragments was observed directly below the pavement structure fills.

At test pits TP16-1 to -3, completed uphill of the existing road alignment, the subsurface profile consisted of a surficial layer of sand and gravel overlying a firm to stiff silty clay deposit. The thickness of the sand and gravel layer ranged from 2.4 m at TP16-1 to 0.3 m at TP16-3, becoming thinner the farther down the slope. This granular layer also contains both cobbles and boulders, with boulders up to 500 mm in diameter being encountered at TP16-1. The underlying silty clay deposit is brown to grey in colour and contains trace amounts of fine sand. Geonor vane test results ranged from 36 kPa to 84 kPa, indicating the deposit has a “firm” to “stiff” consistency.

A perched groundwater table was encountered at TH16-3 and -4 at a depth of 2.1 m below the road surface. At TH16-5, a standpipe piezometer was installed on the afternoon of June 1, 2016 to a depth of 15.2 m below grade. On the morning of June 3, the water level in the standpipe was recorded at a depth of 13.0 m. Given the low permeability soils encountered at this location, it was anticipated water levels had not stabilized during this period of time. A repeat standpipe reading was made on November 22, and the water level was approximately 6.6 m below pavement surface.

During the supplemental test pits, seepage and pit wall sloughing was noted either during or immediately following excavation. In general, the seepage was noted to be entering the test pits near the base of the surficial sand and gravel layer.

## 4.2 Wickaninnish Day Use Area Parking Lots

As shown on Drawing No. 12047-5, four test holes (TH16-8 to -11) were completed in the Wickaninnish Day Use Area, including a single test hole in each of the parking lots and one test hole on the Beach Access Road. Test hole depths ranged from 1.5 m to 3.0 m below pavement. Similar ground conditions were encountered at each location as outlined below.

### 4.2.1 Pavement Structure

The pavement structure was observed to consist of 50 mm of asphalt pavement underlain by a 250 mm to 700 mm thick layer of brown, moist, sand and gravel fill containing gravel sizes to 50 mm diameter and a trace of silt. This pavement aggregate is a pit run product (i.e., not crushed). Table 4.2 summarizes the pavement structure fill encountered, and also notes the depth to groundwater, if encountered.

Table 4.2 – Summary of Pavement Structure Fill for Day Use Parking Lots

Test Hole No.	Drilled Depth (m)	Asphalt Thickness (mm)	Pavement Structure Fill Thickness (mm)	Depth to Groundwater (m)	Pavement Structure Fill Description
16-8	3.0	50	250	2.1	SAND & GRAVEL, trace silt
16-9	1.5	50	250	n/a	SAND & GRAVEL, trace silt
16-10	1.5	50	250	n/a	SAND & GRAVEL, trace silt
16-11	1.5	50	700	n/a	SAND & GRAVEL, trace silt

### 4.2.2 Subgrade Soils

The above noted pavement structure was underlain by a deposit of moist, brown sand with trace silt at all locations (i.e., beach sand). Wet soil conditions were encountered at TH16-8 at a depth of approximately 2.1 m and likely represents the groundwater table at this location.

## 4.3 Kwisitis Visitor Centre Parking Lot

Four test holes (TH16-12 to -15) were completed in the Kwisitis Visitor Centre parking lot, as shown on Drawing 12047-5 attached in Appendix A. Each hole was drilled to a depth of 1.5 m below grade, and a dynamic cone penetration test (DCPT) was completed at TH16-12 to evaluate the density of granular soils.



#### 4.3.1 Pavement Structure

Similar pavement structure was encountered at each test hole, and consisted of 50 mm to 75 mm of asphalt pavement underlain by a 250 mm thick layer of sandy gravel to gravelly sand fill. This granular fill layer was observed to contain a trace of silt and trace amounts of roots and wood debris. A slight hydrocarbon odour was detected in the granular fill layer at test hole TH16-13.

Table 4.3 summarizes the pavement structure fill encountered at the visitor centre parking lot, and also notes the depth to groundwater, if encountered.

Table 4.3 – Summary of Pavement Structure Fill at Visitor Centre Parking Lot

Test Hole No.	Drilled Depth (m)	Asphalt Thickness (mm)	Pavement Structure Fill Thickness (mm)	Depth to Groundwater (m)	Pavement Structure Fill Description
16-12	1.5	50	250	1.4	Gravelly SAND, trace silt, trace roots
16-13	1.5	75	225	1.2	Sandy GRAVEL, trace silt, slight hydrocarbon odour
16-14	1.5	50	250	n/a	Sandy GRAVEL, trace silt, trace wood debris
16-15	1.5	50	250	n/a	SAND and GRAVEL, trace silt

#### 4.3.2 Subgrade Soils

Immediately beneath the above noted pavement structure, a 100 mm to 300 mm thick layer of dark brown to black silty sand was observed at all four test hole locations. This silty sand layer contained varying amounts of gravel (i.e., trace gravel to gravelly) and organic material and generally had a slight organic odour. A deposit of brown sand with trace to some silt was encountered beneath the organic silty sand layer at all four test holes completed at the visitor centre parking lot.

Saturated sands was encountered at depths of 1.4 m and 1.2 m below the parking lot grade at test holes TH16-12 and -13, respectively. This likely represents the groundwater table in this area. Groundwater was not encountered at TH16-14 and -15, which were terminated a depth of 1.5 m.

Based on the DCPT blowcount values from TH16-12, the pavement structure and organic silty sand layers are in a compact to dense condition, whereas the underlying beach sand deposit is in a compact condition. Further details are presented on the test hole logs in Appendix B.

#### 4.4 Florencia Bay Day Use Area Parking Lot and Access Road

Four test holes (TH16-16 to -19) were completed on the Florencia Bay Access Road. An additional four test holes (TH16-20 to -23) were completed at the Florencia Bay Parking Lot. Locations are shown on Drawing Nos. 12047-2 and -3 in Appendix A. The access road is paved. It appears that the centre section of the parking lot has been paved or chip-sealed in the past, but edges of the lot (where vehicles are parked) is gravel surfaced. Test hole depths ranged from 1.5 m to 3.0 m below the pavement/gravel surface.

##### 4.4.1 Pavement Structure

Details on the pavement structure, including asphalt thickness and depth to ground water (if encountered) are summarized below in Table 4.4.

Table 4.4 – Summary of Pavement Structure Fill at Florencia Bay Area

Test Hole No.	Drilled Depth (m)	Asphalt Thickness (mm)	Pavement Structure Fill Thickness (mm)	Depth to Groundwater (m)	Pavement Structure Fill Description
16-16	3.0	50	1150	1.1	SAND and GRAVEL, trace silt
16-17	1.5	75	225	1.2	Gravelly SAND, trace silt
16-18	1.5	50	250	0.8	SAND and GRAVEL, trace silt
16-19	3.0	100	500	1.3	Sandy GRAVEL
16-20	1.5	n/a	300	n/a	SAND and GRAVEL, trace silt
16-21	1.5	n/a	300	n/a	Sandy GRAVEL, trace silt
16-22	1.5	n/a	300	n/a	SAND and GRAVEL, trace silt
16-23	1.5	n/a	300	n/a	Sandy GRAVEL, trace silt

##### 4.4.2 Subgrade Soils

Variable subgrade conditions were encountered along the Florencia Bay Access Road alignment. At TH16-16, located near a low-lying area, a 450 mm thick layer of dark brown to black organic sandy silt was encountered directly below the pavement structure fill, and was underlain by a deposit of fine to medium sand with trace gravel and varying silt content (silty to trace silt). At TH16-17 and -18, the native subgrade soils consist of a sandy gravel deposit with varying silt content. Test hole TH16-19, completed where the road passes through a wetland area, encountered a 600 mm thick layer of peat directly below the pavement structure fills. The peat layer is underlain by a 600 mm thick layer of sand which overlies a firm silty clay deposit.

At test holes TH16-20 to -22, a 300 mm organic layer directly underlies the pavement structure fill; however, the composition of the organic layer varied with location. This organic layer was observed to overly a silty clay deposit at all three of these test hole locations, that extended to 1.5 m depth (i.e., the end of hole). No such organic layer was encountered at TH16-23. At this location, the subgrade consists of a clayey sand and gravel deposit.

Groundwater was encountered along the Florencia Bay access road between a depth of 0.8 m and 1.3 m below top of asphalt. Groundwater was not encountered at any of the test holes completed at the parking lot area; however, we understand this area is subject to seasonal flooding.

Additional details are provided on the test hole and test pit logs included in Appendix B.

## **5. RECONNAISSANCE VISIT OBSERVATIONS**

A reconnaissance visit was completed on May 27, 2016 to select proposed test hole locations and to conduct a cursory review of pavement condition. The following is a summary of pertinent observations made during the May 27<sup>th</sup> visit, including sample photographs. Additional photos from the visit are provided in Appendix C.

### **5.1 Wick Road from Shorepine Bog to Ocean Terrace Road**

This section of Wick Road crosses relatively flat ground and the road is elevated approximately 1.0 m to 1.2 m above adjacent ditches. The ditches were dry during the reconnaissance visit, but we understand that water accumulates in low lying areas along both sides of the road during the winter season.

A moderate amount of ravelling (loss of aggregate) of the asphalt has occurred due to aging and weathering, resulting in a rough pavement surface. Longitudinal cracking was observed along the centreline pavement joint, as well as occasional transverse cracks. Single lane overlays have been constructed along sections of the road (predominantly the east-bound lane). A number of patched pot holes were also observed and appear to be related to localized settlement of subgrade soils. In some areas the edge of pavement is not adequately supported by shoulder fills.



Wick Road – note longitudinal cracks at centreline and surface weathering



Wick Road – patched pothole and unsupported edge of pavement

## 5.2 Wickaninnish Beach Access Road and Parking Lots

The Wickaninnish Beach parking lots and access road appear to have performed well given the age of the pavement, suggesting the pavement structure is generally well drained. Surface runoff appears to be directed away from the beach, towards a swale on the east side of each lot, where it then drains via culverts into a boggy area on the east side of the access road. A significant amount of vegetation has accumulated along the edge of pavement within the parking lots and



roadway, and is impeding drainage. It appears the east edge of the parking lots may undergo periodic flooding during storms. Longitudinal cracking was observed in these areas, and grass is growing in the cracks. Tree roots are also causing localized damage to the pavement surface in some areas, including a section of the access road near the washroom building.



Beach Parking Lots - note longitudinal cracks and vegetation in swale and along edge of pavement

### **5.3 Kwisitis Visitor Centre Parking Lot**

The Kwisitis Visitor Centre parking lot has not performed as well as the beach access parking lots to the north. It appears the parking lot previously incorporated a number of flower beds or planters, which were subsequently removed to accommodate additional parking stalls. The asphalt pavement within these former planter areas has numerous potholes, apparently due to settlement of underlying pavement structure or subgrade soils. Similar dips are evident elsewhere within the lot. Longitudinal cracks are relatively common along joints and the asphalt surface is rough from weathering. The pavement does not appear to be adequately graded to promote surface run-off, and it appears that water collects in many of the potholes following rain events.



Kwisitis Parking Lot – numerous potholes/depressions within and around the perimeter of a former planter area.

#### **5.4 Florencia Bay Access Road and Parking Lot**

The access road to Florencia Bay is approximately 1 km long and, with the exception of two short pull out areas, the paved surface is generally 4.2 m wide. Generally the asphalt surface is in reasonably good shape, with minimal cracking. However, the shoulder fills are generally inadequate, and the edge of pavement is commonly unsupported. Given the narrow road width, it is suspected that when cars driving in opposite directions meet, the cars must drive onto the steep shoulder, which is likely accelerating the deterioration of the shoulder fills. In some areas the asphalt is undermined and failures have occurred at the edge of pavement.

Compared to Wick Road, vegetation control on the access road to Florencia Bay is poor. Small shrubs were common in the ditches and along the shoulder of the road. Organic matter has also accumulated in the ditches, reducing their capacity.





Florencia Bay Access – edge of pavement failure due to inadequate shoulder fills. Note cobbly embankment fill.



Florencia Bay Access – unsupported edge of pavement and inadequate ditching.

### 5.5 Wick Road S-Curve Section

At the west end of Wick Road the alignment transitions into a sharp S-curve section where it travels downhill to the beach access road, dropping in elevation approximately 15 m over a distance of roughly 150 m. The upper section of the alignment is entire in cut (where the road enters the S-curve), but fill placement was required on the downhill side of the alignment for the middle and lower sections of the S-curve. Differential settlement is occurring where the road transitions from a cut section to a fill section. Additional settlement has apparently occurred within the fill section of the alignment, likely related to ongoing creep-movement of the fill materials. This has resulted in pavement cracking across the roadway, but particularly within the lane located on the downhill side of the road. It appears that fill has been dumped over the edge of the embankment near Sta. 0+130 in an attempt to stabilize the edge of the road. Vertical movement of approximately 50 mm were observed across one crack near the downhill edge of pavement. It appears this section of the road has been re-paved/patched a number of times.



Wick Road Slope – pavement cracking and settlement where the road transitions from cut to fill construction.





Wick Road Slope – oversteepened fill slope on downhill side of road.



Wick Road Slope – pavement cracking and settlement within fill section of embankment.

## **6. RE-ALIGNMENT OF WICK ROAD S-CURVE**

### **6.1 General Discussion**

An approximately 60 m long section of Wick Road is experiencing significant distress due to ongoing differential settlement of embankment fill materials. This section of Wick Road passes through an S-curve as the alignment traverses from the top of a coastal bluff down to beach level. The materials exposed on the slope are interpreted as marine clay deposits overlain with a veneer of sand, gravel, cobbles and boulders. The marine clays were deposited at a time when the regional ground surface was depressed and submerged, under the weight of glacial ice. The surficial granular deposits were subsequently laid down when upland glaciers melted, and the materials trapped on/within the glacial ice were released. After the glaciers melted, the ground surface re-bounded resulting in the exposure of these formerly submerged deposits. Since that time, the bluffs along the Pacific Rim National Park have experienced cycles of erosion and beach deposition. Currently, the S-Curve section of Wick Road is set back a significant distance from Wickaninnish Beach, and it appears that limited erosion of the slope has occurred in recent years. However, the previous erosional processes have left the slope with a nominal factor of safety.

The ongoing road movements and pavement distress are expected to continue unless the overall slope is flattened and the pavement structure is improved. We understand flattening the slope below the road (i.e., by placing additional fill) is not desirable as it would negatively impact high value habitat and trees. The preferred approach is to re-align the road and shift it towards the east (i.e., in the up-slope direction). A significant alignment shift is proposed, as the re-aligned road will incorporate a new 3.2 m wide multi-use trail on the outside edge of the road alignment. To accommodate the re-aligned and widened road, either a new retaining wall is needed on the uphill side of the alignment (to retain the slope above the road), or the slope above the road will need to be trimmed back to a flatter angle.

### **6.2 Geotechnical Assessments**

#### **6.2.1 Retaining Wall Option**

Initially it was proposed to construct a wall to retain the existing slope above the re-aligned S-curve section of Wick Road. A precast concrete “lock-block” gravity wall system was selected, with a typical height of 5 blocks (3.75 m) and the lowest row of blocks mostly buried. To provide adequate sliding and overturning resistance, rotation of the lowest two rows of blocks would also be required. The maximum permissible slope above the wall would be 2H to 1V.

In order to construct the wall, significant temporary excavations would be required above the wall, and these would result in a temporary reduction in slope stability. It was anticipated the wall would

need to be built in stages to reduce the potential for a slope failure. Once wall construction was completed, the overall factor of safety against slope failure was predicted to improve; however, the factor of safety would fall short of the typical target value of 1.5 for an engineered structure.

### 6.2.2 Flattened Slope Option

Rather than constructing a wall to retain the slope above the upgraded road, another option is to re-grade the upper slope to a flatter angle. The current average slope gradient above the road ranges from approximately 2.1H to 1V to about 2.9H to 1V, with localized steeper sections approaching 1H to 1V. The planned realigned and widened road will result in the toe of the future re-graded slope being shifted significantly to the east (i.e., in the upslope direction).

Thurber conducted analyses to evaluate the beneficial impacts of slope flattening, assuming a nominal final slope angle of 3H to 1V (18°). For this analysis, we assumed a surficial granular blanket would remain on the final re-graded slope to improve surficial stability and provide long-term erosion protection. An approximately 25% improvement in long-term stability over the current situation was predicted for a 3H to 1V final slope. It is noted that the analysis results are impacted significantly by the location of the groundwater table, as well as the thickness and properties of the marine clay deposit. As this information was only available along the existing road alignment, assumptions were made as to the geometry of the groundwater table and foundation soils under the slope.

### 6.2.3 Selected Design

We understand the desired approach is to flatten the slope above the re-aligned S-curve section, rather than construct a retaining wall. Given the slopes current marginal stability, re-grading should proceed from the top downwards rather than from the bottom (i.e., the current road grade) upwards. Excavating from the bottom upwards could induce a slope failure.

It is anticipated that granular soils will be exposed on the upper section of the re-graded slope but that this will transition to the marine clays part-way down the cut slope. Thurber's recommended design included the placement of a minimum 750 mm thick granular blanket on the slope to improve erosion resistance and surface stability, especially in areas where seepage exits the slope (anticipated to be at/near the contact of the marine clay and overlying granular mantle). We understand the selected approach does not include placement of a granular blanket on the surface of the re-graded slope. Deletion of the granular blanket will simplify construction, but will increase the potential for subsequent surface erosion, particularly for the sections of the slope where clay is exposed. Depending on the amount of seepage exiting the slope, there is also the possibility for localized "piping" of fine sand and silt to occur where groundwater exits the slope.

It is anticipated that alternate erosion control measures, such as Erosion Control Blankets (ECBs), can be employed to limit surface erosion of the final slope. However, these sorts of measures will likely have limited effect in regards to improving surface stability at seepage locations.

The excavated slope should be re-vegetated promptly after construction. The potential impacts of seepage on slope performance should be monitored closely over the first few years following construction. If piping cavities should develop, remedial measures (such as the placement of a granular filter) should be implemented to locally treat these zones.

## **7. PAVEMENT STRUCTURE RECOMMENDATIONS**

### **7.1 Roads and Parking Lots**

The following pavement structure is recommended for new pavements:

Asphalt Pavement (AP):	75 mm for Wick Road / 50 mm for Parking Lots
Crushed Base Course (CBC)	200 mm
Select Granular Sub-Base (SGSB)	250 mm

All pavement structure aggregates should meet either MOTI or MMCD specifications. A summary of pavement recommendations for specific project areas is also provided in Table 7.1, including subgrade preparation recommendations.

Where existing asphalt is removed, a portion of the existing asphalt may be re-used when manufacturing the new pavement. The amount of recycled asphalt should be limited to 30% by weight, as per Section 505 of BC Ministry of Transportation and Infrastructure Standard Specifications (Category B roads).

The new Wick Road pavement structure incorporates 75 mm of asphalt pavement. Given the site location, it could be difficult achieving the required asphalt compaction if the pavement were placed in a single lift, particularly if the asphalt is sourced from some distance. If the Contractor elects to place the asphalt in two lifts, we recommend a minimum lift thickness of 40 mm.

Where sub-excavation is carried out to remove unsuitable subgrade soils, the excavation should be backfilled with approved granular backfill. Depending on the circumstances and prevailing groundwater conditions, the following backfill materials are anticipated:

- Select Granular Sub-Base (SGSB): as per BC MOTI Section 202
- Rockfill: well-graded, free-draining 200 mm minus blast rock
- Crushed Coarse Aggregate: 9.5 mm to 75 mm clear crushed aggregate

Conventional embankment fill and pavement structure materials should be compacted in accordance with BC MOTI requirements. Rockfill to be compacted with a minimum of 4 passes of a vibratory 10-tonne roller, or as otherwise directed by the Engineer.

As noted in Table 7.1, geosynthetic base reinforcement is recommended where the subgrade surface is soft following sub-excavation. The base reinforcement should consist of a geotextile separator that is overlain with a biaxial geogrid. The following minimum material properties are recommended:

Geotextile separator:

Grab Tensile Strength > 700 N (ASTM-D4632),  
CBR Puncture > 1800 N (ASTM-D6241).

Biaxial Geogrid:

Tensile Strength @ 2% Strain: 6.0 kN/m (MARV)  
Flexural Stiffness: 750,000 mg-cm

The key to the success of the any pavement structure is adequate drainage. This includes the provision and maintenance of adequate ditching and culverts to keep the pavements structure fills unsaturated. Subgrade surfaces should also be sloped towards ditches to promote drainage.

## **7.2 New Multi-Use Trail**

A 3.2 m wide paved multi-use trail will adjoin the south (eastbound) side of Wick Road from approximately Sta. 0+290 to Sta. 1+400. Near the entrance of the S-curve section of the road alignment, the trail will cross over to the north (westbound) side of the road, where it will run alongside the road until the base of the hill. Along both road sections, the paved trail surface will be contiguous with that of the paved road surface, but the road and trail will be separated by a concrete no-post barrier. We understand the proposed pavement structure for the trail is 50 mm of asphalt pavement underlain by 225 mm of crushed base course aggregate. This is considered to be a suitable pavement structure. If soft subgrade conditions are encountered along the trail alignment, we recommend the same subgrade preparation steps be employed as for the adjoining road areas.



Table 7.1: Summary of Pavement Structure Recommendations

Road/Lot	Station	Option 1
Wick Road (S-curve)  TH16-5 to -7 TP16-1 to -3	0+020 to 0+275	<ul style="list-style-type: none"> <li>• Shift road alignment east (uphill) to avoid section with greatest pavement distress/settlement. Remove existing asphalt pavement (AP) and any unsuitable fill materials across future road width.</li> <li>• Excavate to design sub-grade elevation. Where exposed subgrade is soft, excavate another 250 mm and place geosynthetic base reinforcement, consisting of a geotextile and overlying biaxial geogrid. Backfill with SGSB or another approved granular fill.</li> <li>• Construct new pavement structure as follows:               <ul style="list-style-type: none"> <li>○ 75 mm AP</li> <li>○ 200 mm CBC</li> <li>○ 250 mm SGSB</li> </ul> </li> <li>• Where possible, trim steep fill slope below roadway to 3H:1V.</li> </ul>
Wick Road  TH16-1 to -4	0+275 to 1+675	<ul style="list-style-type: none"> <li>• Remove existing pavement. Remove underlying sand and gravel fill (approx. 500mm thick) and retain for re-use.</li> <li>• The underlying subgrade to be evaluated by inspection and a roll test to confirm the requirements for additional excavation and replacement.               <ul style="list-style-type: none"> <li>○ Where <u>organic</u> soils are exposed or are revealed by the roll test, these materials are to be removed to the depth directed by the Engineer.</li> <li>○ Where inspection or roll test reveal soft or weak <u>non-organic</u> subgrade, these soils to be excavated another 250 mm and replaced with approved granular backfill.</li> <li>○ Where the exposed subgrade following sub-excavation remains soft, install geosynthetic base reinforcement, consisting of a geotextile and overlying biaxial geogrid. Restore to base of pavement structure level using approved granular fill.</li> </ul> </li> <li>• Construct new pavement structure as follows:               <ul style="list-style-type: none"> <li>○ 75 mm AP</li> <li>○ 200 mm CBC</li> <li>○ 250 mm SGSB (Min)</li> </ul> </li> <li>• Re-construct embankment side slopes no steeper than 2H to 1V</li> </ul>
Wickaninnish Day Use Parking Lots	n/a	<ul style="list-style-type: none"> <li>• Locally repair potholes and pavement disturbed by root action.</li> <li>• Route and fill cracks and open joints.</li> </ul>

TH16-9 to -11		<ul style="list-style-type: none"> <li>• Clean existing pavement surface. Apply tack coat and install 40mm thick asphalt overlay.</li> <li>• Deepen swales, remove built-up vegetation along road, upgrade culverts, clean out ditch on east side of road, check for and remove any blockages on east side of road</li> </ul>
Wickaninnish Day Use Access Road  TH16-8	n/a	<ul style="list-style-type: none"> <li>• Locally repair/replace potholes and pavement disturbed by root action. Route and seal cracks and open joints.</li> <li>• Improve ditching and remove built-up vegetation along road. Upgrade culverts as required.</li> </ul>
Kwisitis Visitor Centre Parking Lot  TH16-12 to -15	n/a	<ul style="list-style-type: none"> <li>• Remove existing pavement. Remove underlying granular fill and retain any re-usable material (test hole data indicates most of the existing parking lot fill will be unsuitable for re-use).</li> <li>• The underlying subgrade to be evaluated by inspection and a roll test to confirm the requirements for additional excavation and replacement.             <ul style="list-style-type: none"> <li>○ Where <u>organic</u> soils are exposed or are revealed by the roll test, these materials are to be removed to the depth directed by the Engineer.</li> <li>○ Where inspection or roll test reveal soft or weak <u>non-organic</u> subgrade, these soils to be excavated another 250 mm and replaced with approved granular backfill.</li> <li>○ Where the exposed subgrade following sub-excavation remains soft, install geosynthetic base reinforcement, consisting of a geotextile and overlying biaxial geogrid. Restore to design base of sub-base level using approved granular fill.</li> </ul> </li> <li>• Construct new pavement structure as follows:             <ul style="list-style-type: none"> <li>○ 50 mm AP</li> <li>○ 200 mm CBC</li> <li>○ 250 mm SGSB (Min)</li> </ul> </li> <li>• Improve drainage along north and east sides of lot to intercept run-off from the slope.</li> </ul>
Florenca Bay Access  TH16-16 to -19	To be determined	<ul style="list-style-type: none"> <li>• Widen and re-construct road shoulders to support edge of pavement; provide flatter side slopes for embankment (Min. 2H to 1V)</li> <li>• Remove vegetation along edge of road and restore ditches</li> <li>• Where above requires widening of roadway, remove all topsoil and organic soils to expose underlying mineral soils.</li> <li>• Place geotextile separator on fine-grained (clay, silt) subgrade prior to placement of shoulder fills.</li> <li>• Road widenings constructed across wetland areas</li> </ul>

<p>Florencia Bay Parking Lot</p> <p>TH16-20 to -23</p>	<p>n/a</p>	<ul style="list-style-type: none"> <li>• Remove and retain existing granular fill materials (typically 300 mm thick).</li> <li>• Remove underlying organic soil/rootmat (observed to be 300 to 400 mm thick).</li> <li>• Where the exposed subgrade following excavation is soft, install geosynthetic base reinforcement, consisting of a geotextile and overlying biaxial geogrid. Restore to original subgrade level using approved granular fill.</li> <li>• Construct new pavement structure as follows:             <ul style="list-style-type: none"> <li>○ 50 mm AP</li> <li>○ 200 mm CBC</li> <li>○ 250 mm SGSB (Min)</li> </ul> </li> </ul>
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## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



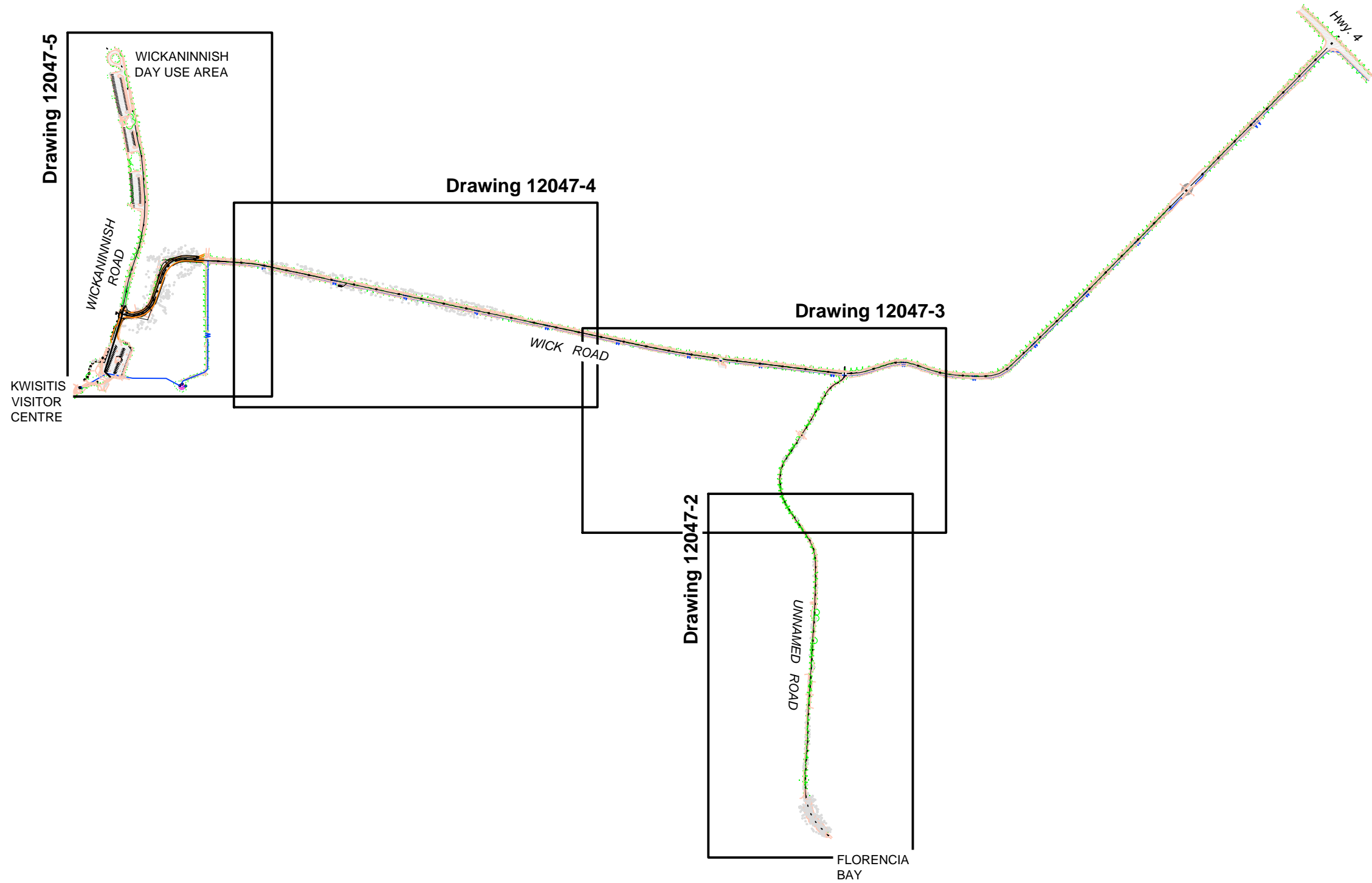




## **APPENDIX A**

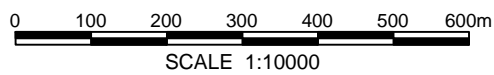
### **Site Plan**


#### **Test Hole Location Plan (Sheets 1 of 4)**

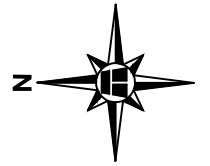


**NOTES:**

1. Test holes were located by using a hand-held GPS unit; locations are approximate only.
2. Digital base plan provided by Parsons, January 13, 2017.



 <p><b>THURBER ENGINEERING LTD.</b></p>		PARSONS			
		<b>SITE PLAN</b>			
		WICK ROAD GEOTECHNICAL INVESTIGATION		UCLUELET, B.C.	
DESIGNED JDM	DRAWN RRS	APPROVED <i>[Signature]</i>	DATE JANUARY 13, 2017	SCALE 1:10,000	PROJECT No.   DWG. NO.   REV. 12047 - 1   -   -



FLORENCIA BAY

TH16-17

TH16-18

UNNAMED ROAD

TH16-19

TH16-20

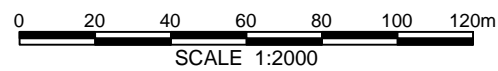
TH16-21



TH16-22

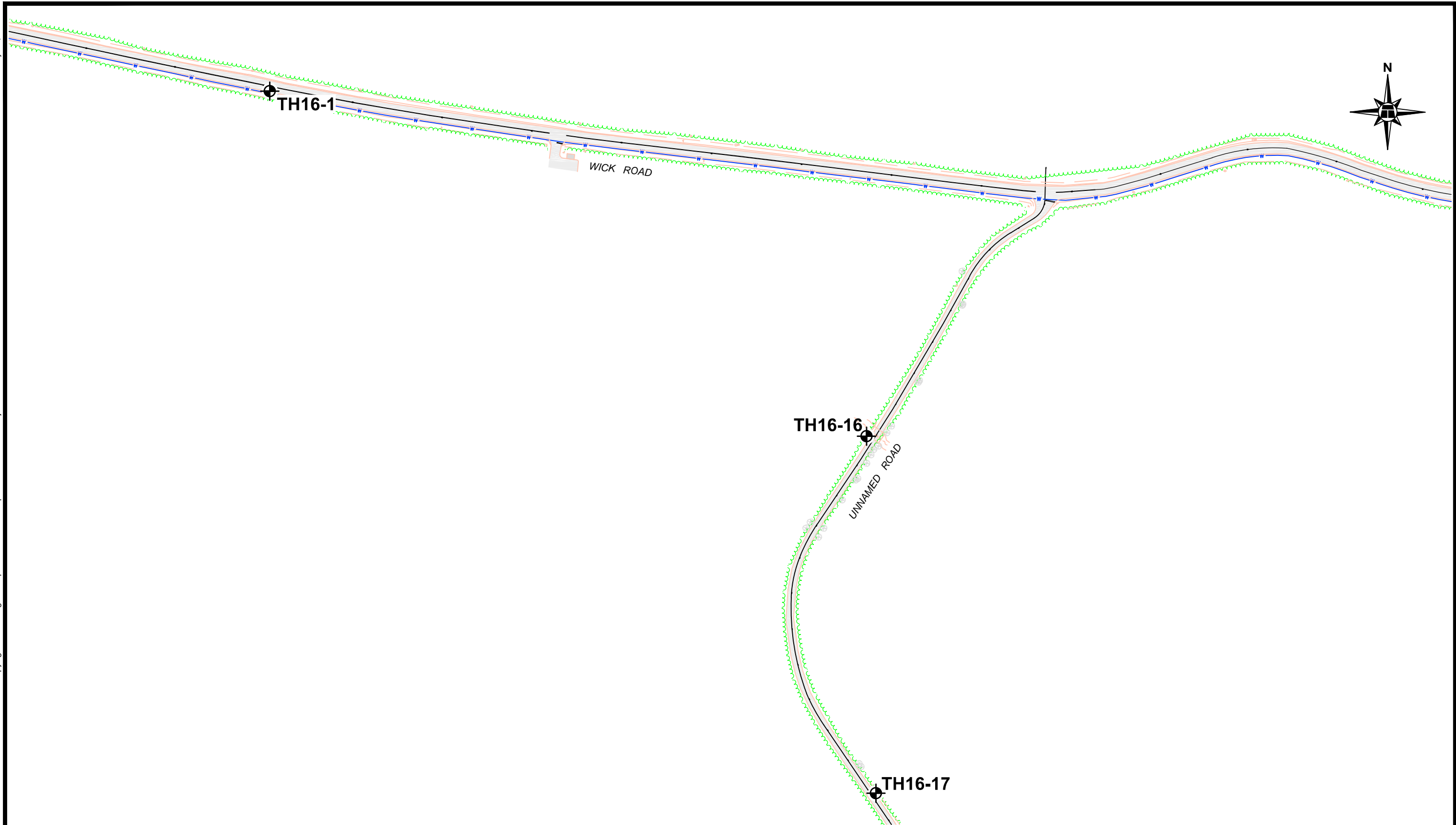
TH16-23

**NOTES:**

1. Test holes were located by using a hand-held GPS unit; locations are approximate only.
2. Digital base plan provided by Parsons, January 13, 2017.

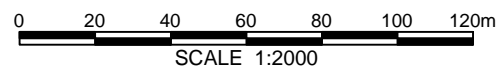




 <b>THURBER ENGINEERING LTD.</b>			PARSONS				
			<b>TEST HOLE LOCATION PLAN</b> <b>(Sheet 1 of 4)</b>				
DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
JDM	RRS		JANUARY 13, 2017	1:2000	12047 - 2	UCLUELET, B.C.	-

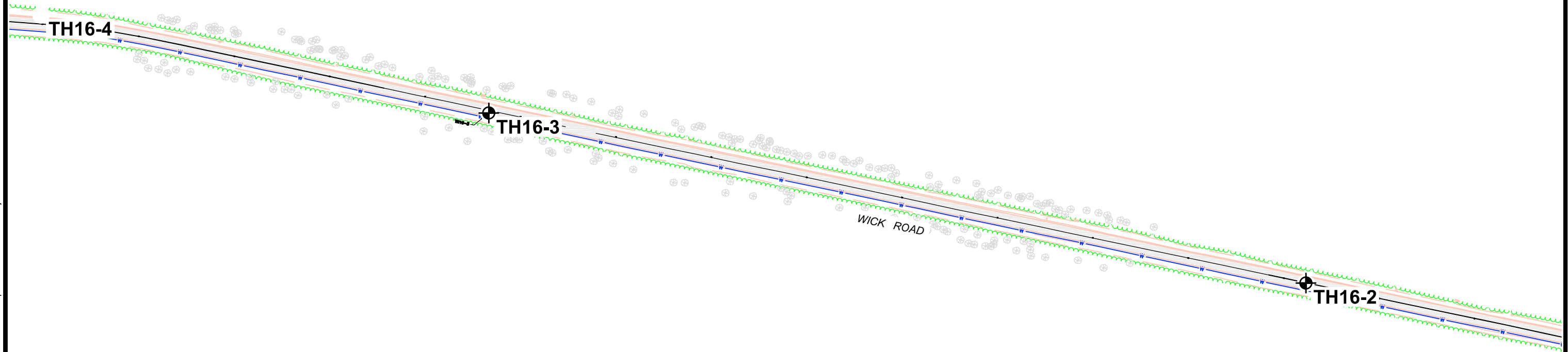
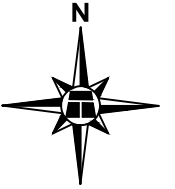


**NOTES:**

1. Test holes were located by using a hand-held GPS unit; locations are approximate only.
2. Digital base plan provided by Parsons, January 13, 2017.

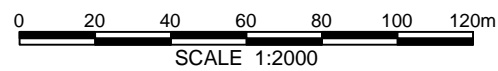




 <b>THURBER ENGINEERING LTD.</b>		PARSONS					
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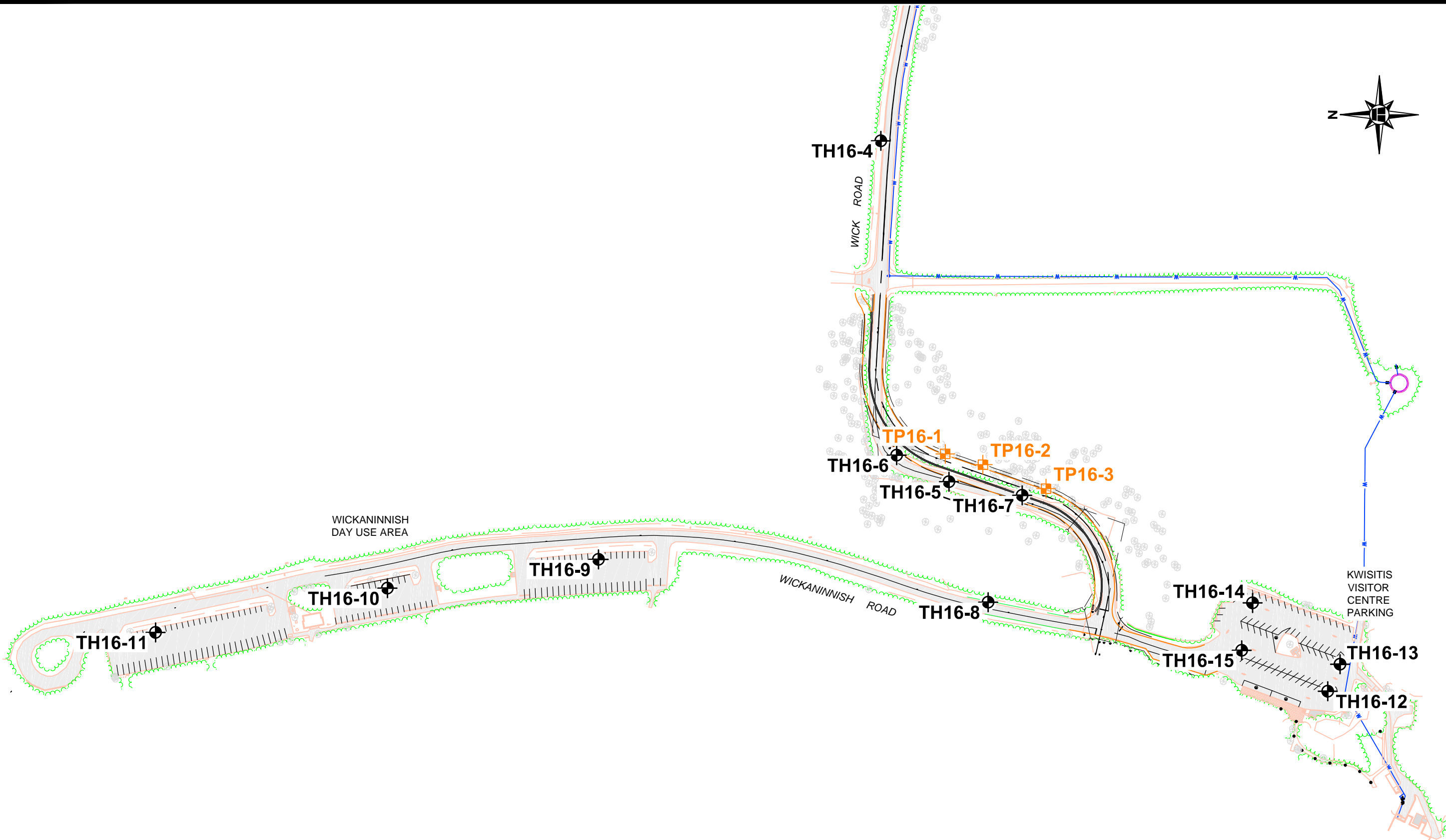
**NOTES:**

1. Test holes were located by using a hand-held GPS unit; locations are approximate only.
2. Digital base plan provided by Parsons, January 13, 2017.



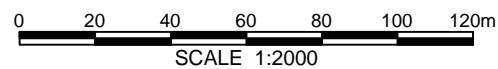
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JDM		RRS		JANUARY 13, 2017	1:2000	12047 - 4	UCLUELET, B.C.	-






**NOTES:**

1. Test holes were located by using a hand-held GPS unit; locations are approximate only.
2. Digital base plan provided by Parsons, January 13, 2017.



 <b>THURBER ENGINEERING LTD.</b>			PARSONS				
			<b>TEST HOLE LOCATION PLAN</b> <b>(Sheet 4 of 4)</b>				
DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
JDM	RRS	<i>JRM</i>	JANUARY 13, 2017	1:2000	12047 - 5		-

WICK ROAD  
GEOTECHNICAL INVESTIGATION

UCLUELET, B.C.





## **APPENDIX B**

### **Unified Classification System for Soils (ASTM D2487)**

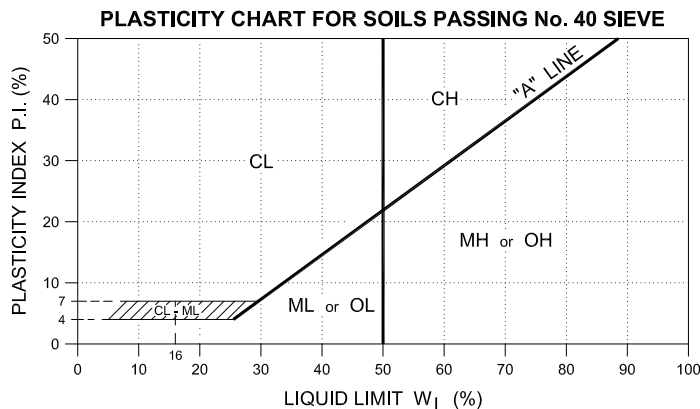
#### **Symbols and Terms used on the Test Logs**

#### **Test Hole & Test Pit Logs**



# UNIFIED CLASSIFICATION SYSTEM FOR SOILS (ASTM D2487)

MAJOR DIVISION		SYMBOLS		TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
		GROUP	GRAPH			
COARSE-GRAINED SOILS (MORE THAN 50% BY WEIGHT RETAINED ON No. 200 SIEVE)	GRAVELS MORE THAN 50% COARSE FRACTION RETAINED ON No. 4 SIEVE	CLEAN GRAVELS ( $< 5\%$ FINES)	<b>GW</b>		WELL GRADED GRAVEL and WELL GRADED GRAVEL with SAND.	$C_U = \frac{D_{60}}{D_{10}} \geq 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			<b>GP</b>		POORLY GRADED GRAVEL and POORLY GRADED GRAVEL with SAND.	NOT MEETING ABOVE REQUIREMENTS
		GRAVELS WITH FINES ( $> 12\%$ FINES)	<b>GM</b>		SILTY GRAVEL, GRAVEL - SAND - SILT MIXTURES.	FINES CLASSIFY AS ML or MH <sup>(3)</sup>
			<b>GC</b>		CLAYEY GRAVEL, GRAVEL - SAND - CLAY MIXTURES.	FINES CLASSIFY AS CL or CH <sup>(3)</sup>
	SANDS MORE THAN 50% COARSE FRACTION PASSES No. 4 SIEVE	CLEAN SANDS ( $< 5\%$ FINES)	<b>SW</b>		WELL GRADED SAND and WELL GRADED SAND with GRAVEL	$C_U = \frac{D_{60}}{D_{10}} \geq 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			<b>SP</b>		POORLY GRADED SAND and POORLY GRADED SAND with GRAVEL.	NOT MEETING ABOVE REQUIREMENTS
		SANDS WITH FINES ( $> 12\%$ FINES)	<b>SM</b>		SILTY SAND, SAND - SILT MIXTURES.	FINES CLASSIFY AS ML or MH <sup>(3)</sup>
			<b>SC</b>		CLAYEY SAND, SAND - CLAY MIXTURES.	FINES CLASSIFY AS CL or CH <sup>(3)</sup>
FINE-GRAINED SOILS (MORE THAN 50% BY WEIGHT PASSES No. 200 SIEVE)	SILTS BELOW "A" LINE NEGLECTIBLE ORGANIC CONTENT	$W_L < 50\%$	<b>ML</b>		INORGANIC SILTS, SILTS with SAND and SILTS with GRAVEL and SANDY or GRAVELLY SILTS.	P.I. $< 4$ or PLOTS BELOW THE "A" LINE
		$W_L > 50\%$	<b>MH</b>		INORGANIC SILTS, SILTS with SAND & SILTS with GRAVEL & SANDY or GRAVELLY SILTS, FINE SANDY or SILTY SOILS.	P.I. PLOTS BELOW THE "A" LINE
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART NEGLECTIBLE ORGANIC CONTENT	$W_L < 50\%$	<b>CL</b>		INORGANIC CLAYS of LOW PLASTICITY, GRAVELLY, SANDY, or SILTY CLAYS, LEAN CLAYS.	P.I. $> 7$ and PLOTS ON OR ABOVE THE "A" LINE
		$W_L$ near 50%	<b>CL-CH</b>		BORDERLINE INORGANIC CLAYS and SILTY CLAYS with LIQUID LIMITS NEAR 50%.	(only used for visual identification)
		$W_L > 50\%$	<b>CH</b>		INORGANIC CLAYS of HIGH PLASTICITY, FAT CLAYS.	P.I. PLOTS ON OR ABOVE THE "A" LINE
	ORGANIC SILTS and CLAYS	$W_L < 50\%$	<b>OL</b>		ORGANIC SILTS and ORGANIC SILTY CLAYS of LOW PLASTICITY.	$\frac{W_L \text{ (oven dried)}}{W_L \text{ (not dried)}} < 0.75$
		$W_L > 50\%$	<b>OH</b>		ORGANIC CLAYS OF HIGH PLASTICITY.	$\frac{W_L \text{ (oven dried)}}{W_L \text{ (not dried)}} < 0.75$
HIGHLY ORGANIC SOILS		<b>PT</b>		PEAT and other HIGHLY ORGANIC SOILS.	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE.	



**NOTES:**

- ALL SIEVE SIZES ARE U.S. STANDARD, A.S.T.M. E11-04.
- COARSE GRAINED SOILS WITH 5 TO 12% FINES REQUIRE DUAL SYMBOLS (GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC).
- IF FINES CLASSIFY CL-ML USE DUAL SYMBOL (GC-GM or SC-SM).
- WHERE TESTING IS NOT CARRIED OUT, THE IDENTIFICATIONS ARE DETERMINED BY VISUAL-MANUAL PROCEDURES DESCRIBED IN ASTM D2488-06.



## SYMBOLS AND TERMS USED ON TEST LOGS

### 1. PARTICLE SIZE CLASSIFICATION OF MINERAL SOILS

DESCRIPTION	APPARENT PARTICLE SIZE
BOULDERS	> 200 mm
COBBLES	75 mm to 200 mm
GRAVEL coarse	19 mm to 75 mm
fine	4.75 mm to 19 mm
SAND coarse	2 mm to 4.75 mm
medium	0.475 mm to 2 mm
fine	0.075 mm to 0.475 mm
SILT	Non-plastic particles, not visible to the naked eye
CLAY	Plastic particles, not visible to the naked eye

NOTE: Metric Conversion is approximate only

### 2. TERMS DESCRIBING CONSISTENCY (Cohesive Soils Only)

DESCRIPTION	APPROXIMATE UNDRAINED SHEAR STRENGTH
Very Soft	Less than 10 kPa (250 psf)
Soft	10 to 25 kPa (250 - 500 psf)
Firm	25 to 50 kPa (500 - 1000 psf)
Stiff	50 to 100 kPa (1000 - 2000 psf)
Very Stiff	100 to 200 kPa (2000 - 4000 psf)
Hard	Greater than 200 kPa (4000 psf)

NOTE: Metric Conversion is approximate only

### 3. TERMS DESCRIBING DENSITY (Cohesionless Soils Only)

DESCRIPTION	STANDARD PENETRATION TEST
	Number of blows per foot (300 mm) *
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

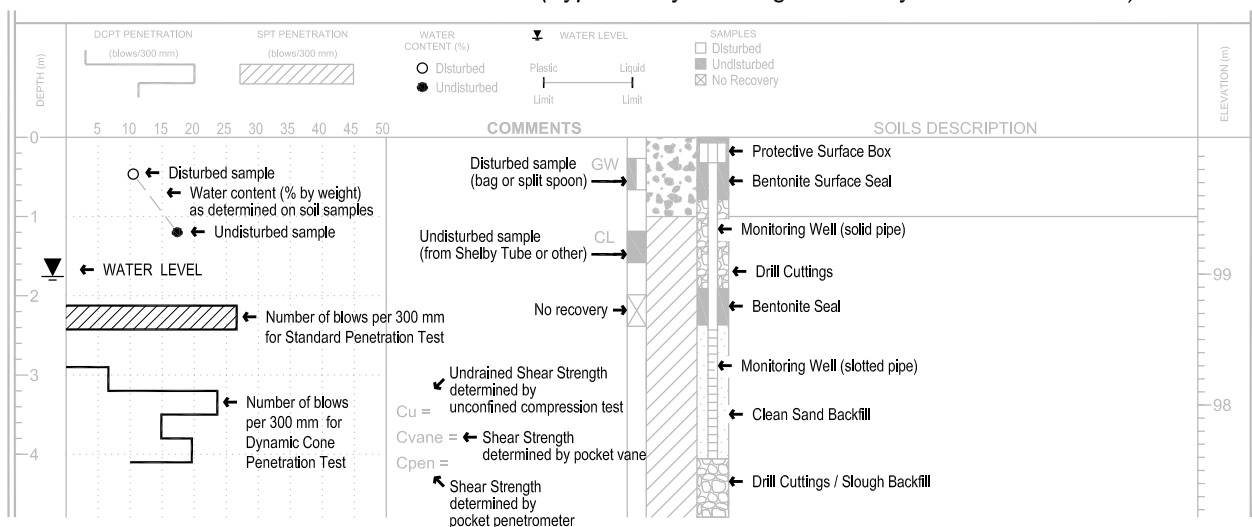
\* Directly applicable to sands and, with interpretation, to gravels

### 4. PROPORTION OF MINOR COMPONENTS BY WEIGHT

DESCRIPTION	PERCENT BY WEIGHT
and	35 to 50 %
y / ey	20 to 35 %
some	10 to 20 %
trace	less than 10 %

**EXAMPLE:** Silty SAND, trace of gravel = Sand with 20 to 35% silt and up to 10% gravel, by dry weight. (Percentages of secondary materials are estimates based on visual and tactile assessment of samples).

### 5. LEGEND FOR TEST HOLE LOGS (Typical only showing commonly included elements)





# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-2**

**LOCATION:** See Drawing No. 12047-4

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger / DCPT

**DATE:** 1-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

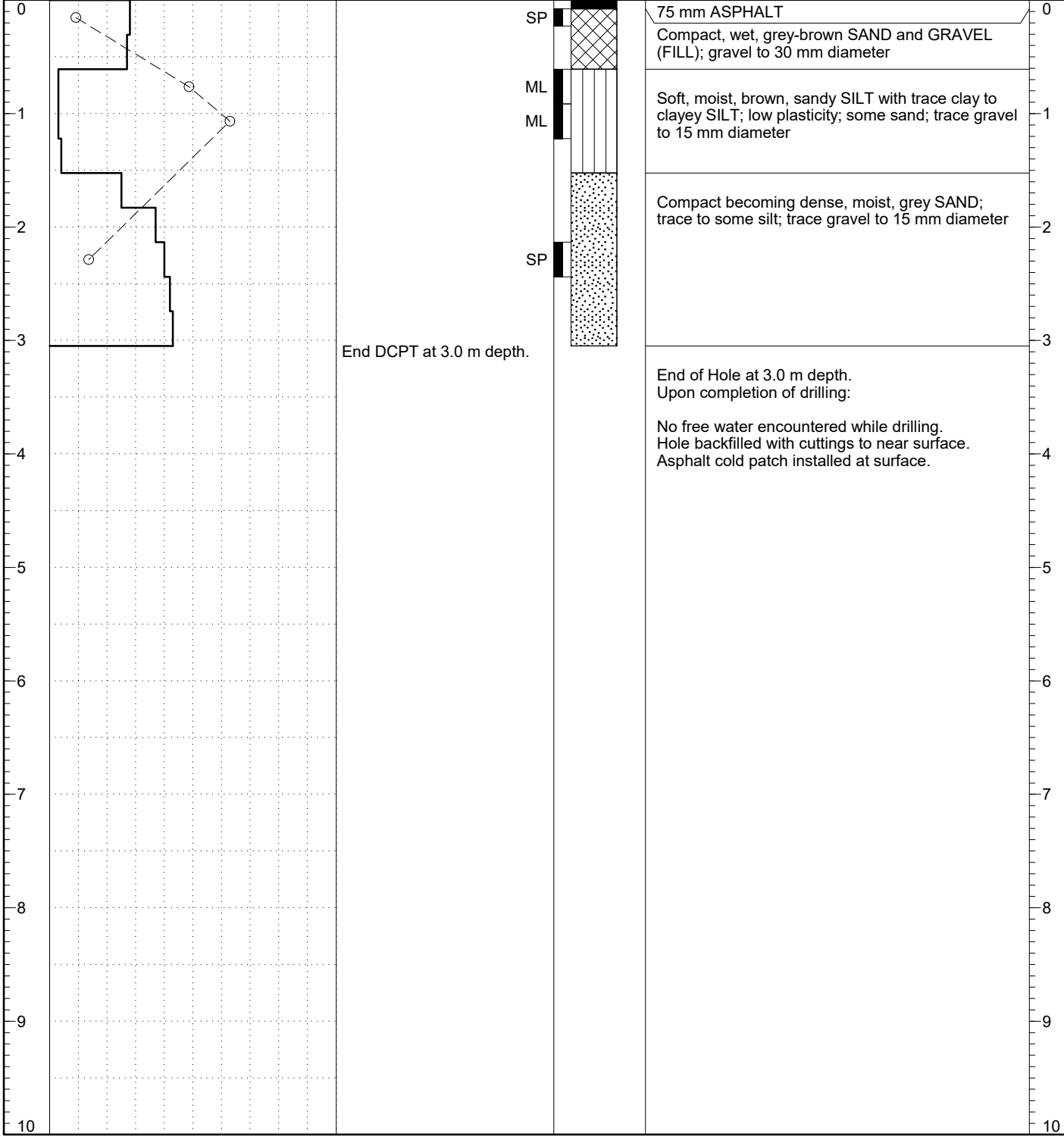
**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊞ PID reading	

**COMMENTS**

**SOILS DESCRIPTION**

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB







# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-4**

**LOCATION:** See Drawing No. 12047-4

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger / DCPT

**DRILLING CO.:** Drillwell Enterprises Ltd.



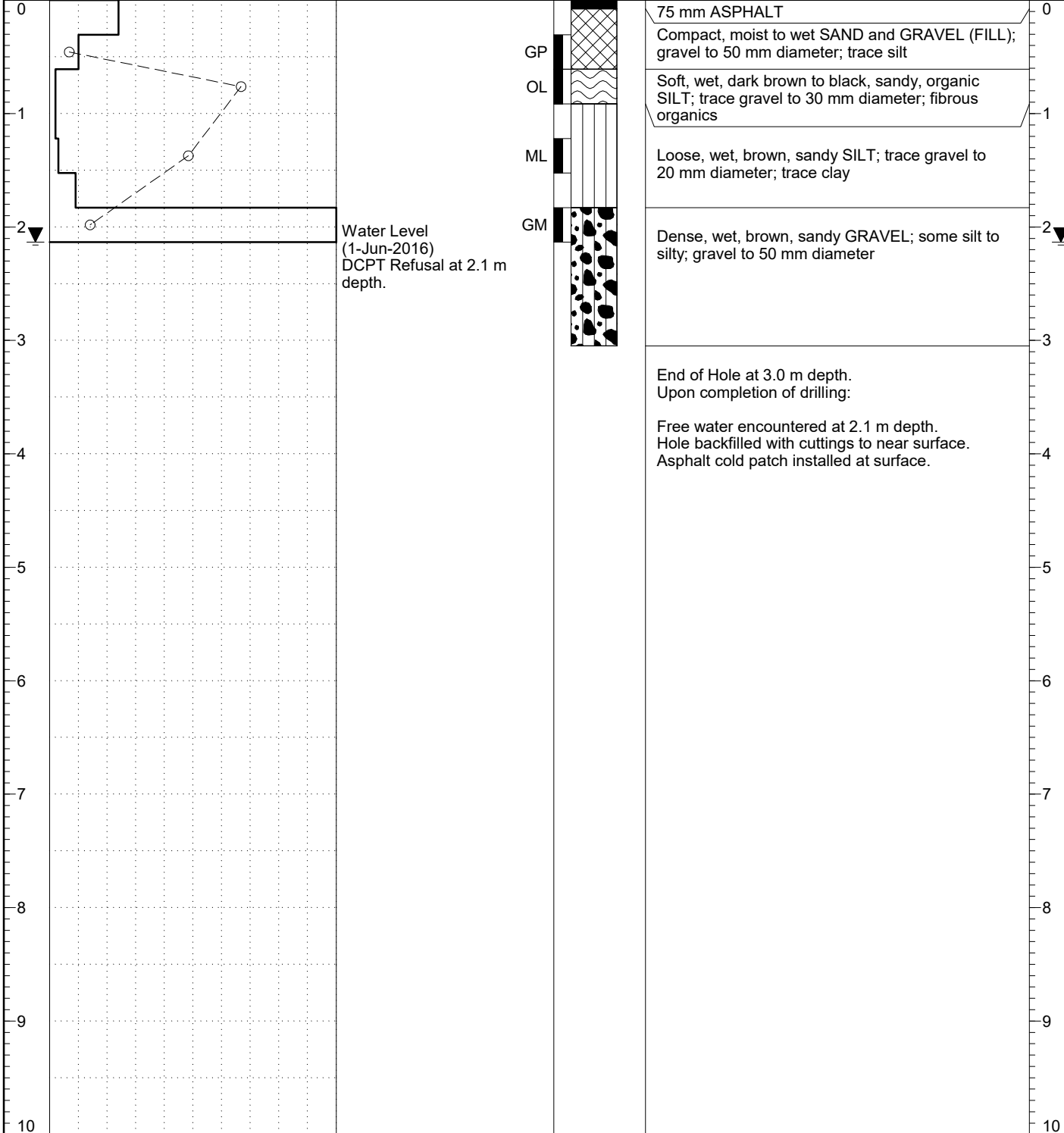
**DATE:** 1-Jun-2016

**INSPECTOR:** ZB

**FILE NO.:** 12047

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊞ PID reading	

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



Water Level (1-Jun-2016)  
DCPT Refusal at 2.1 m depth.

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-5**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger / DCPT

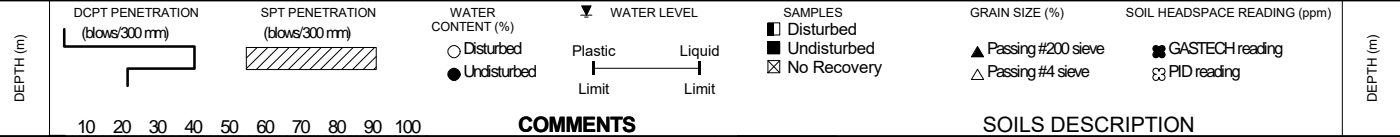
**DRILLING CO.:** Drillwell Enterprises Ltd.



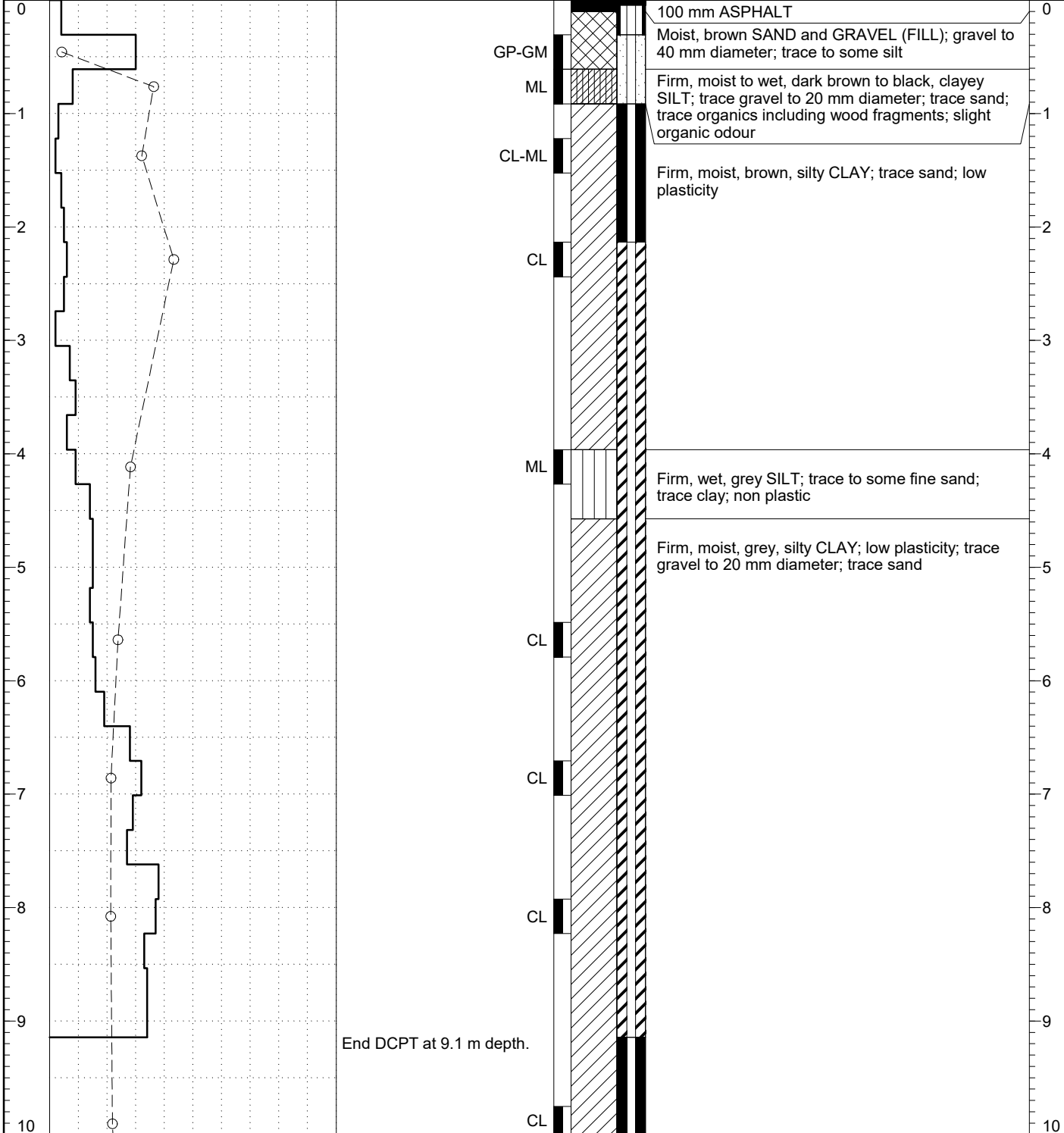
**DATE:** 1-Jun-2016

**INSPECTOR:** ZB

**FILE NO.:** 12047



LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-5**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger / DCPT

**DATE:** 1-Jun-2016

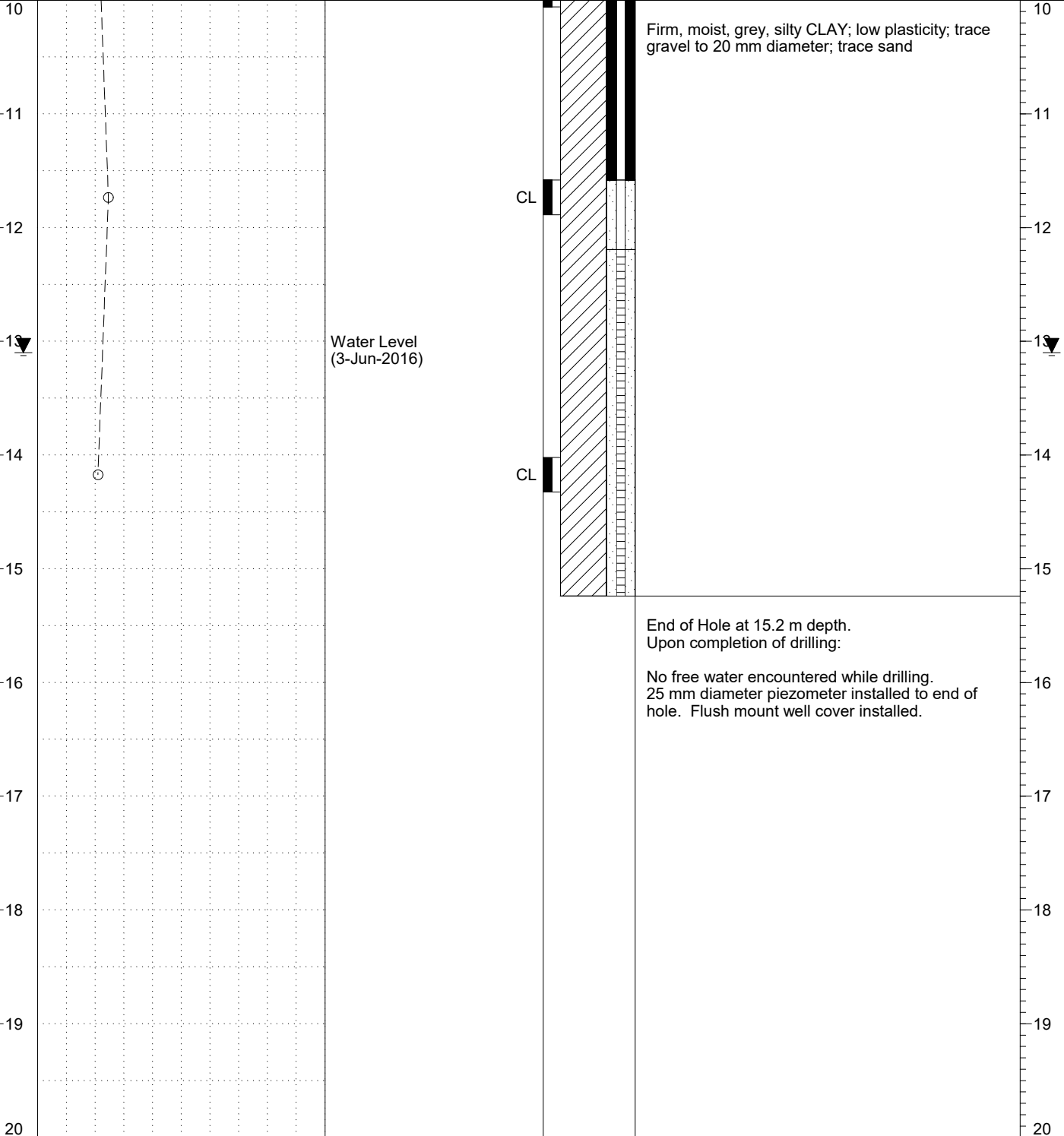
**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ⊠ No Recovery	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ⊞ PID reading	DEPTH (m)
	COMMENTS		SOILS DESCRIPTION					



LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-6**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger / DCPT

**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

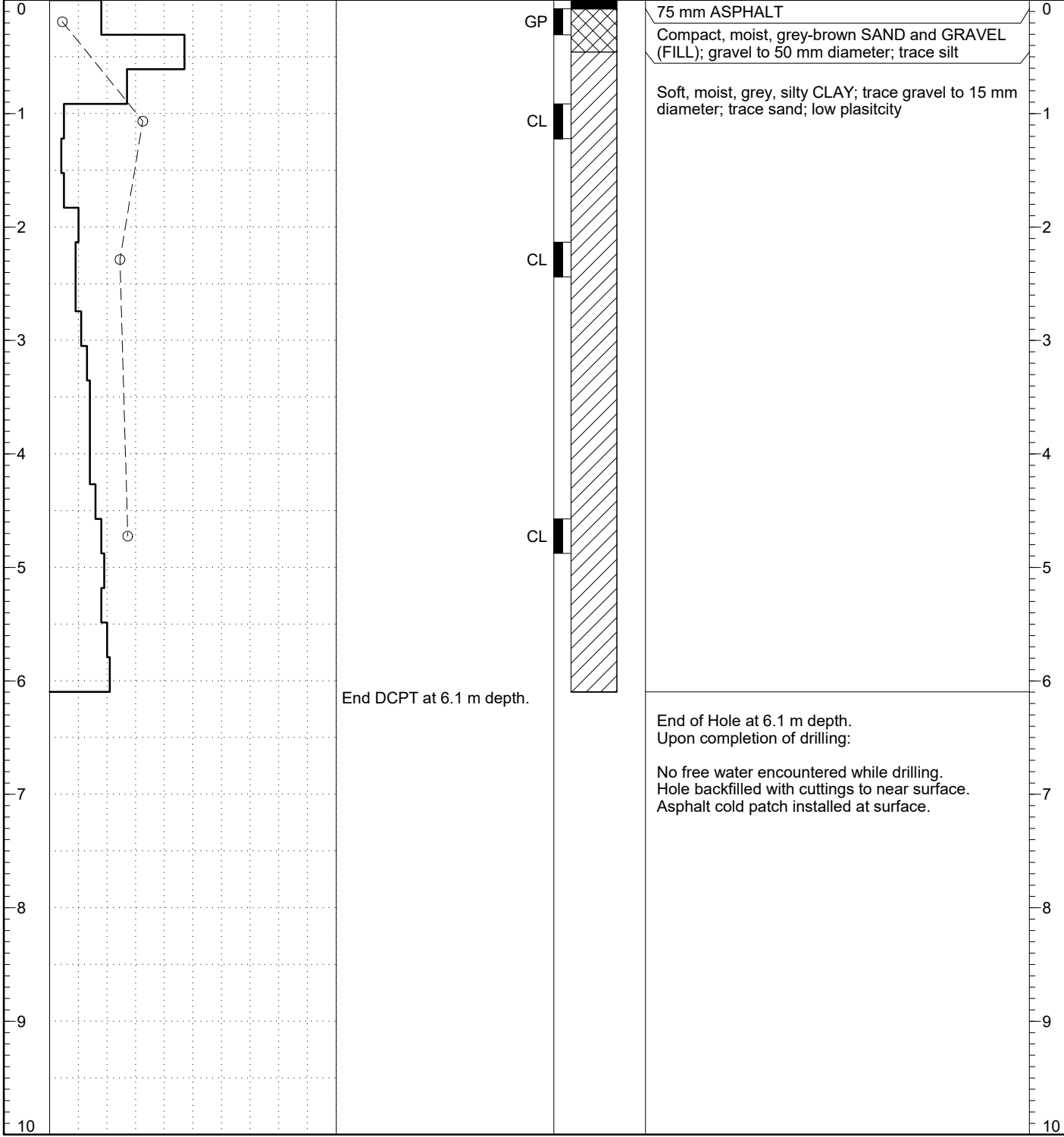
**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed ■ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	

**COMMENTS**

**SOILS DESCRIPTION**

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



End DCPT at 6.1 m depth.

End of Hole at 6.1 m depth.  
Upon completion of drilling:  
  
No free water encountered while drilling.  
Hole backfilled with cuttings to near surface.  
Asphalt cold patch installed at surface.

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-7**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger / DCPT



**DATE:** 2-Jun-2016

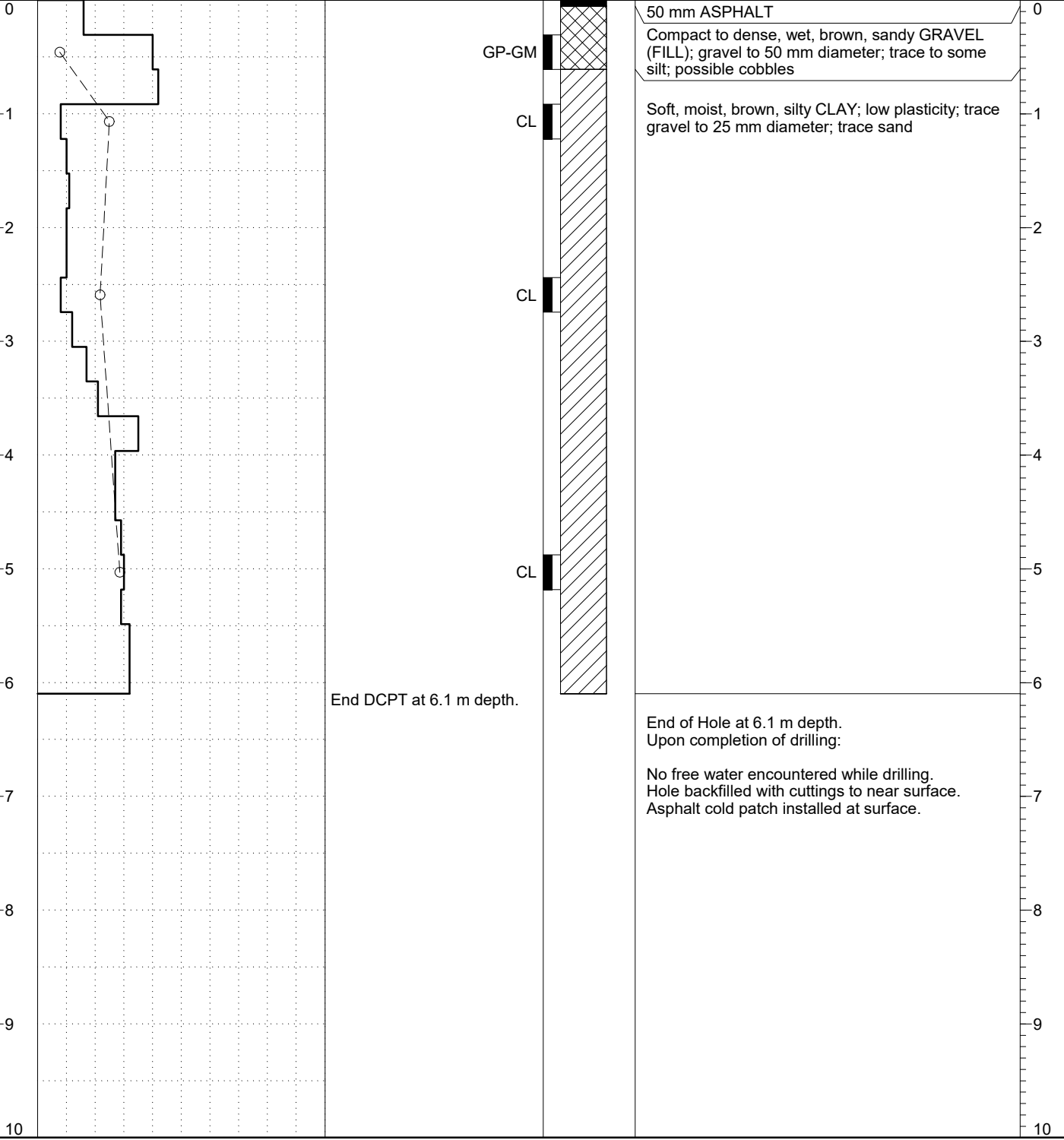
**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed ■ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



End DCPT at 6.1 m depth.

50 mm ASPHALT  
Compact to dense, wet, brown, sandy GRAVEL (FILL); gravel to 50 mm diameter; trace to some silt; possible cobbles

Soft, moist, brown, silty CLAY; low plasticity; trace gravel to 25 mm diameter; trace sand

End of Hole at 6.1 m depth.  
Upon completion of drilling:  
  
No free water encountered while drilling.  
Hole backfilled with cuttings to near surface.  
Asphalt cold patch installed at surface.

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-8**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger

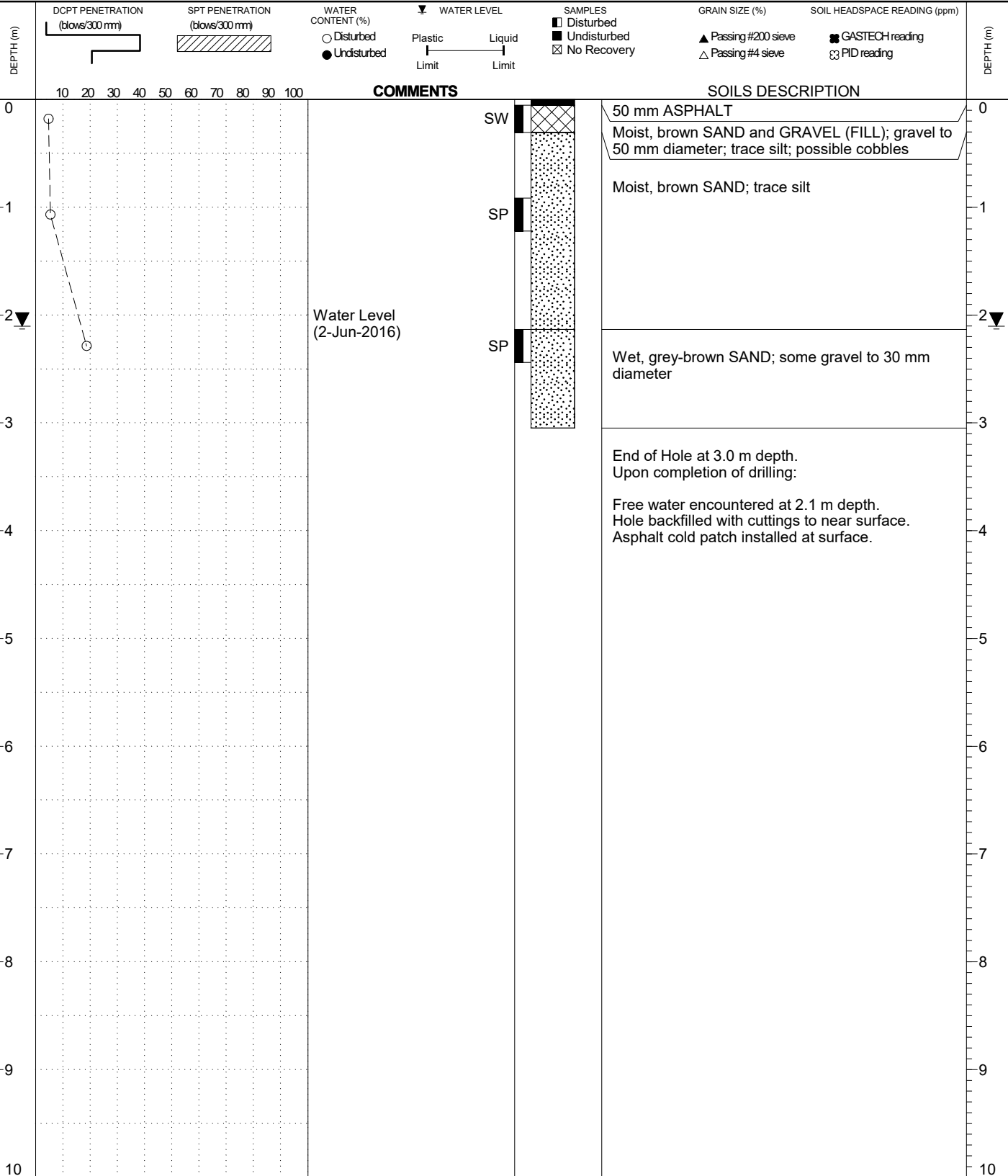
**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB



LOG OF TEST HOLE (NO EST.) R. RRS. 12047 - WICK ROAD, 2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 - THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-9**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road  
Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		<b>COMMENTS</b>		<b>SOILS DESCRIPTION</b>				
0					SW		50 mm ASPHALT	0
0					SP-SM		Moist, brown SAND and GRAVEL (FILL); gravel to 30 mm diameter; trace silt	
1					SP		Moist, brown SAND and GRAVEL; gravel to 40 mm diameter; trace to some silt; trace wood debris; slight organic odour	1
1.5							Moist, brown SAND; trace silt; trace roots	
1.5							End of Hole at 1.5 m depth. Upon completion of drilling:	2
2							No free water encountered while drilling. Hole backfilled with cuttings to near surface. Asphalt cold patch installed at surface.	
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-10**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger

**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ⊠ No Recovery	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ⊠ PID reading	DEPTH (m)
	COMMENTS		SOILS DESCRIPTION					

0		SP		0
1	○	SP	Moist, brown SAND and GRAVEL (FILL); gravel to 20 mm diameter; trace silt	1
2			Moist, brown SAND; trace silt	2
3			End of Hole at 1.5 m depth. Upon completion of drilling: No free water encountered while drilling. Hole backfilled with cuttings to near surface. Asphalt cold patch installed at surface.	3
4				4
5				5
6				6
7				7
8				8
9				9
10				10

LOG OF TEST HOLE (NO EST.) R. RRS. 12047 - WICK ROAD, 2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 - THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-11**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ☒ No Recovery	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ☒ PID reading	DEPTH (m)
	COMMENTS			SOILS DESCRIPTION				

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

0		SW	50 mm ASPHALT		0
1		SP		Moist, brown, gravelly SAND; gravel to 40 mm diameter; trace silt	1
1.5				Moist, brown SAND; trace silt	1.5
2				End of Hole at 1.5 m depth. Upon completion of drilling:	2
2.5				No free water encountered while drilling. Hole backfilled with cuttings to near surface. Asphalt cold patch installed at surface.	2.5
3					3
4					4
5					5
6					6
7					7
8					8
9					9
10					10

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-12**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road  
Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger

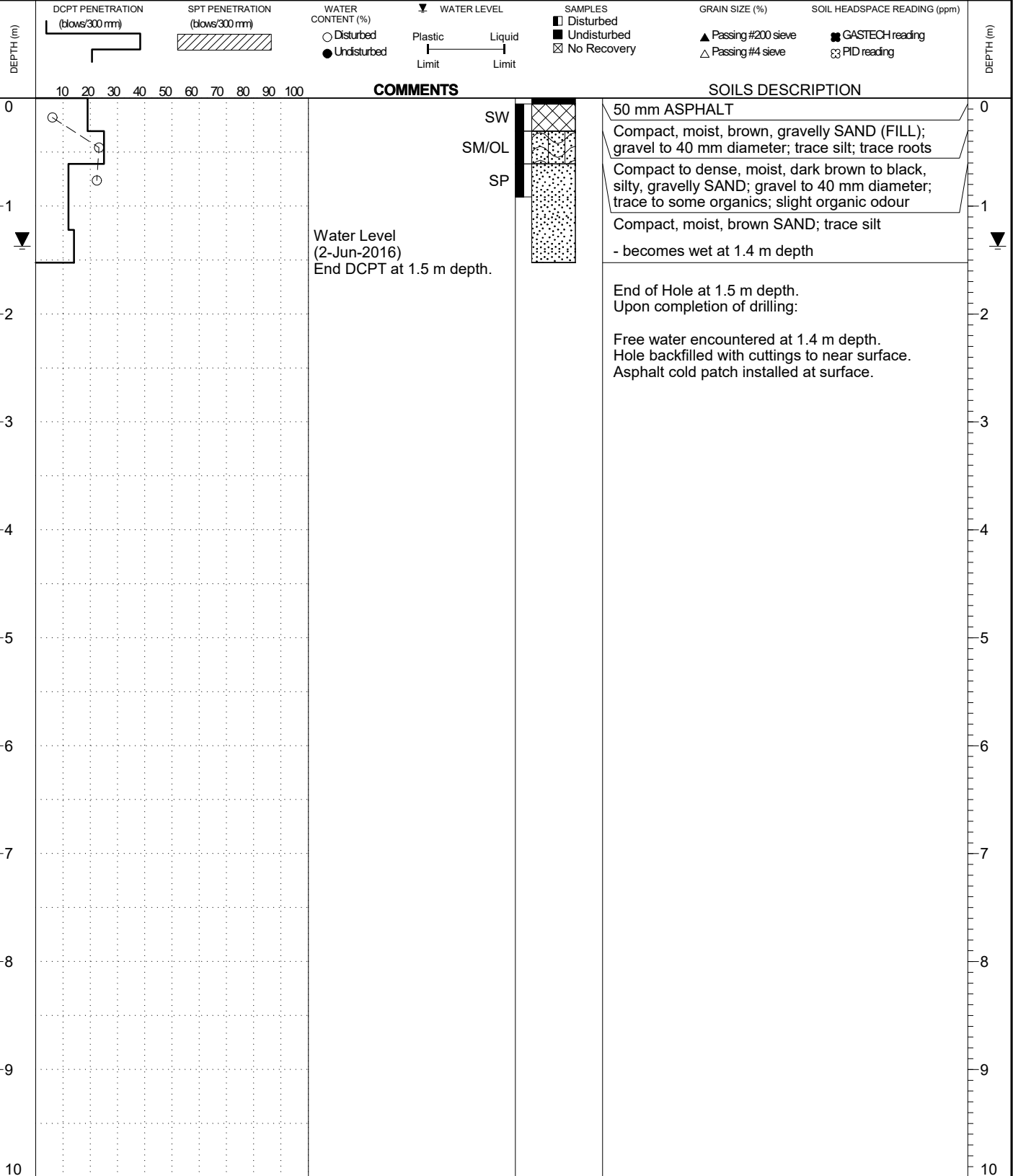
**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB



LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-13**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger

**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		COMMENTS			SOILS DESCRIPTION			
0					GW	75 mm ASPHALT		0
0.5					SM/OL	Wet, brown, sandy GRAVEL (FILL); gravel to 40 mm diameter; trace silt; slight hydrocarbon odour		
1.0					SM	Moist, dark brown to black, silty, gravelly SAND; gravel to 40 mm diameter; trace to some organics		
1.2						Moist, brown SAND; some silt		
1.5						- becomes wet at 1.2 m depth		
1.5						End of Hole at 1.5 m depth. Upon completion of drilling:		
1.5						Free water encountered at 1.2 m depth. Hole backfilled with cuttings to near surface. Asphalt cold patch installed at surface.		
2.0								2
3.0								3
4.0								4
5.0								5
6.0								6
7.0								7
8.0								8
9.0								9
10.0								10

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-14**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		COMMENTS			SOILS DESCRIPTION			
0					GW			0
0					SM/OL			0
1					SP-SM			1
1.5								1.5
2								2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

50 mm ASPHALT

Moist, brown, sandy GRAVEL (FILL); gravel to 50 mm diameter; trace silt; trace wood debris

Moist, dark brown to black, silty SAND; trace gravel to 20 mm diameter; trace to some organics

Moist, brown SAND; trace to some silt

End of Hole at 1.5 m depth.  
Upon completion of drilling:

No free water encountered while drilling.  
Hole backfilled with cuttings to near surface.  
Asphalt cold patch installed at surface.

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-15**

**LOCATION:** See Drawing No. 12047-5

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger

**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

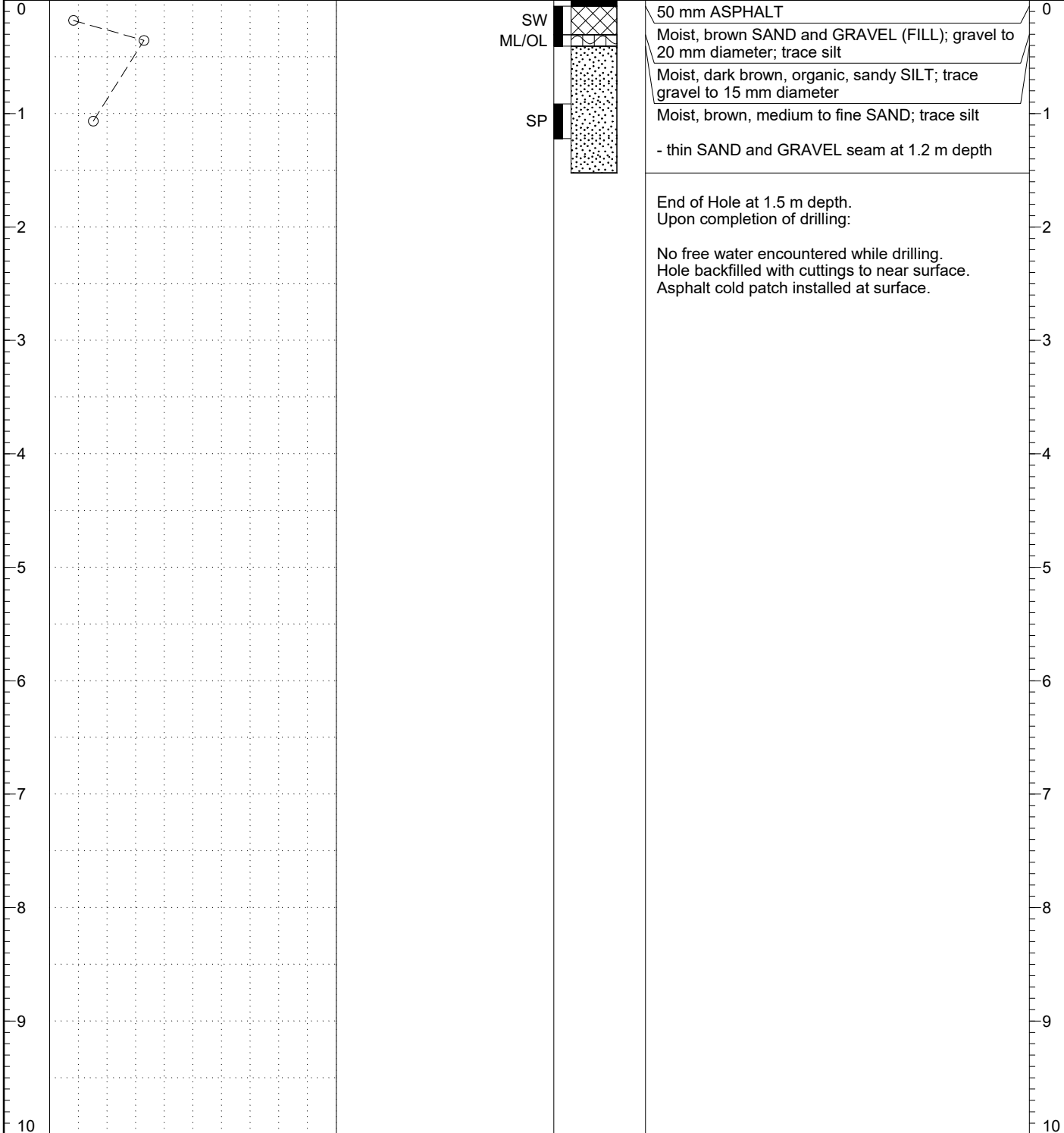
**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ⊠ No Recovery	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ⊠ PID reading	DEPTH (m)
	COMMENTS		SOILS DESCRIPTION					

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-16**

**LOCATION:** See Drawing No. 12047-3

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger

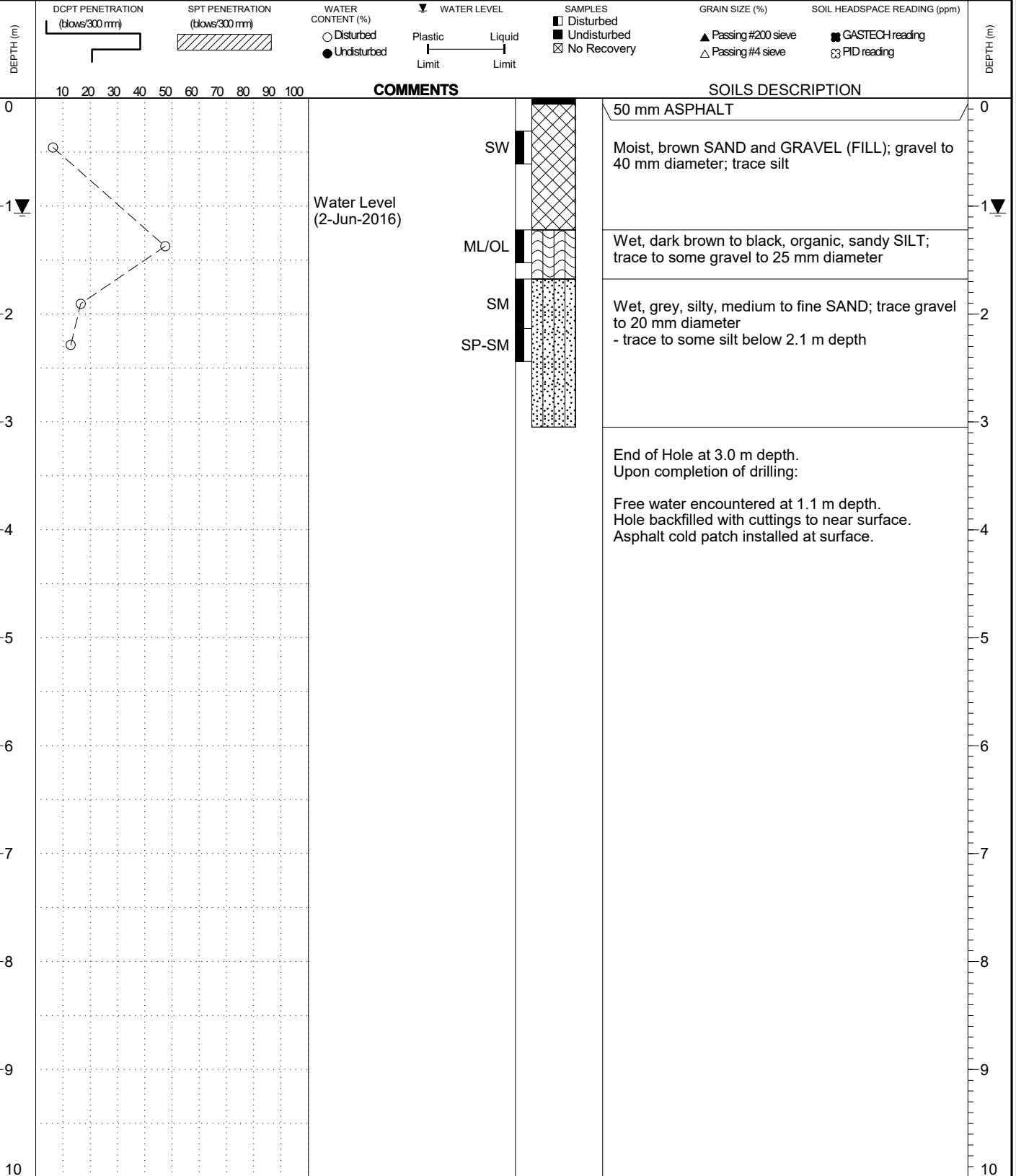


**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB



LOG OF TEST HOLE (NO EST.) R. RRS. 12047 - WICK ROAD, 2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 - THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-17**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger

**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		COMMENTS			SOILS DESCRIPTION			
0					SW SP-SM GM			0
0								0
1								1
1				Water Level (2-Jun-2016)				1
2								2
2							End of Hole at 1.5 m depth. Upon completion of drilling:	2
3							Free water encountered at 1.2 m depth. Hole backfilled with cuttings to near surface. Asphalt cold patch installed at surface.	3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-18**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger

**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**THURBER**

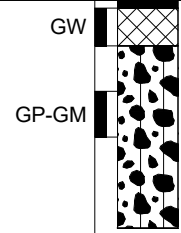
**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
COMMENTS					SOILS DESCRIPTION			
0								0
0.05					GW			0.05
0.1								0.1
0.2								0.2
0.3								0.3
0.4								0.4
0.5								0.5
0.6								0.6
0.7								0.7
0.8								0.8
0.9								0.9
1.0								1.0
1.1								1.1
1.2								1.2
1.3								1.3
1.4								1.4
1.5								1.5
1.6								1.6
1.7								1.7
1.8								1.8
1.9								1.9
2.0								2.0
2.1								2.1
2.2								2.2
2.3								2.3
2.4								2.4
2.5								2.5
2.6								2.6
2.7								2.7
2.8								2.8
2.9								2.9
3.0								3.0
3.1								3.1
3.2								3.2
3.3								3.3
3.4								3.4
3.5								3.5
3.6								3.6
3.7								3.7
3.8								3.8
3.9								3.9
4.0								4.0
4.1								4.1
4.2								4.2
4.3								4.3
4.4								4.4
4.5								4.5
4.6								4.6
4.7								4.7
4.8								4.8
4.9								4.9
5.0								5.0
5.1								5.1
5.2								5.2
5.3								5.3
5.4								5.4
5.5								5.5
5.6								5.6
5.7								5.7
5.8								5.8
5.9								5.9
6.0								6.0
6.1								6.1
6.2								6.2
6.3								6.3
6.4								6.4
6.5								6.5
6.6								6.6
6.7								6.7
6.8								6.8
6.9								6.9
7.0								7.0
7.1								7.1
7.2								7.2
7.3								7.3
7.4								7.4
7.5								7.5
7.6								7.6
7.7								7.7
7.8								7.8
7.9								7.9
8.0								8.0
8.1								8.1
8.2								8.2
8.3								8.3
8.4								8.4
8.5								8.5
8.6								8.6
8.7								8.7
8.8								8.8
8.9								8.9
9.0								9.0
9.1								9.1
9.2								9.2
9.3								9.3
9.4								9.4
9.5								9.5
9.6								9.6
9.7								9.7
9.8								9.8
9.9								9.9
10.0								10.0

LOG OF TEST HOLE (NO EST.) R. RRS. 12047 - WICK ROAD, 2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 - THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

Water Level  
(2-Jun-2016)



**50 mm ASPHALT**  
Moist, brown SAND and GRAVEL (FILL); gravel to 25 mm diameter; trace silt

**GP-GM**  
Moist, brown, sandy GRAVEL; gravel to 25 mm diameter; trace to some silt  
- becomes wet at 0.8 m depth

End of Hole at 1.5 m depth.  
Upon completion of drilling:  
Free water encountered at 0.8 m depth.  
Hole backfilled with cuttings to near surface.  
Asphalt cold patch installed at surface.



# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-19**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger / DCPT

**DRILLING CO.:** Drillwell Enterprises Ltd.

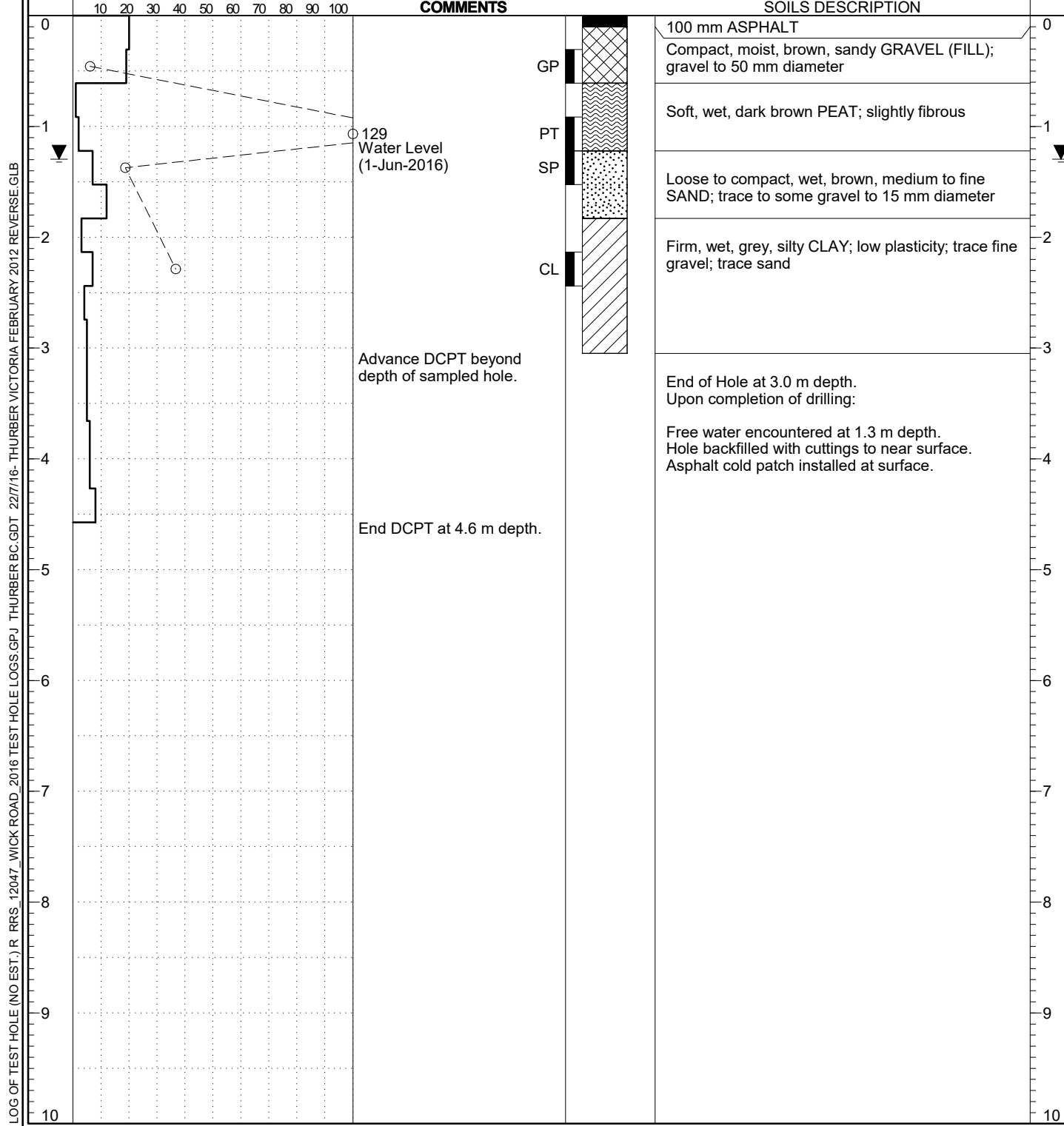


**DATE:** 2-Jun-2016

**INSPECTOR:** ZB

**FILE NO.:** 12047

<p><b>DCPT PENETRATION</b> (blows/300 mm)</p>	<p><b>SPT PENETRATION</b> (blows/300 mm)</p>	<p><b>WATER CONTENT (%)</b></p> <p>○ Disturbed ● Undisturbed</p>	<p><b>WATER LEVEL</b></p> <p>▼ Plastic Limit ▼ Liquid Limit</p>	<p><b>SAMPLES</b></p> <p>■ Disturbed ■ Undisturbed ⊠ No Recovery</p>	<p><b>GRAIN SIZE (%)</b></p> <p>▲ Passing #200 sieve △ Passing #4 sieve</p>	<p><b>SOIL HEADSPACE READING (ppm)</b></p> <p>■ GASTECH reading ⊞ PID reading</p>	<p>DEPTH (m)</p>
---	--	--	---	--	---	---	------------------



LOG OF TEST HOLE (NO EST.) R. RRS. 12047 - WICK ROAD, 2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 - THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-20**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		COMMENTS			SOILS DESCRIPTION			
0					GP			0
0								Moist, grey SAND and GRAVEL (FILL); gravel to 30 mm diameter; trace silt
0								Moist, dark brown, sandy, organic SILT (root mat)
1					CL			1
1								Firm, moist to wet, grey and brown, silty CLAY; low plasticity; trace fine gravel; trace sand
2								2
2								End of Hole at 1.5 m depth. Upon completion of drilling:
2								No free water encountered while drilling. Hole backfilled with cuttings to surface.
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-21**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		COMMENTS			SOILS DESCRIPTION			
0					GP			0
0.5					OL			0.5
1.0					CL-CH			1.0
1.5								1.5
2.0								2.0
3.0								3.0
4.0								4.0
5.0								5.0
6.0								6.0
7.0								7.0
8.0								8.0
9.0								9.0
10.0								10.0

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-22**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊞ PID reading	
		COMMENTS			SOILS DESCRIPTION			
0								0
0.5					PT			0.5
1.0					CL			1.0
1.5								1.5
2.0								2.0
3.0								3.0
4.0								4.0
5.0								5.0
6.0								6.0
7.0								7.0
8.0								8.0
9.0								9.0
10.0								10.0

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB

# LOG OF TEST HOLE

TEST HOLE NO.  
**TH16-23**

**LOCATION:** See Drawing No. 12047-2

**CLIENT:** PARSONS  
**PROJECT:** Wick Road Geotechnical Investigation

**TOP OF HOLE ELEV.:**

**METHOD:** Solid Stem Auger



**DATE:** 2-Jun-2016

**DRILLING CO.:** Drillwell Enterprises Ltd.

**FILE NO.:** 12047

**INSPECTOR:** ZB

DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	DEPTH (m)
			○ Disturbed ● Undisturbed	▼ Plastic Limit ▼ Liquid Limit	■ Disturbed □ Undisturbed ⊠ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊠ PID reading	
		COMMENTS		SOILS DESCRIPTION				
0								0
0.5								0.5
1.0								1.0
1.5								1.5
2.0								2.0
3.0								3.0
4.0								4.0
5.0								5.0
6.0								6.0
7.0								7.0
8.0								8.0
9.0								9.0
10.0								10.0

LOG OF TEST HOLE (NO EST.) R. RRS\_12047\_WICK ROAD\_2016 TEST HOLE LOGS.GPJ THURBER BC.GDT 22/7/16 THURBER VICTORIA FEBRUARY 2012 REVERSE.GLB



**WICK ROAD REALIGNMENT  
TEST PIT LOGS  
NOVEMBER 22, 2016**

**TP16-1 (Sta. 5+158 approx.)**

DEPTH (m)	DESCRIPTION	SAMPLE DEPTH (m)	USCS	M.C. (%)
0.0 – 0.1	TOPSOIL/FORREST LITTER			
0.1 – 2.4	Loose to compact (inferred), brown, moist, SAND and GRAVEL (sub-rounded), trace to some silt; contains frequent cobbles and occasional boulders up to 500 mm diameter - grey below 0.3 m depth - contains clumps of stiff, grey, silty clay at 1.2 m depth - seepage and brown below 1.5 m depth	0.15 – 0.3	GP-GM	12.5
		0.9 – 1.1	GM	7.9
		2.1 – 2.3	SM	18.7
2.4 – 3.0	Firm to stiff, grey, wet, silty CLAY; trace fine sand. - at 2.6 m depth, Geonor Vane Shear Test 50 kPa-60 kPa - at 2.9 m depth, Liquid Limit=36%, Plastic Limit=19%	2.4 - 2.6	CL	27.9
		2.9 – 3.0	CL	24.7
3.0	End of Pit - Vertical walls with some ongoing sloughing and seepage from 1.5 to 2.4 m depth - Backfilled with excavated materials, topsoil restored and erosion protection installed			

Test Pit located approximately 1.8 m higher and 8 m upslope from centre/base of existing ditch.



**WICK ROAD REALIGNMENT  
TEST PIT LOGS  
NOVEMBER 22, 2016**

**TP16-2 (Sta. 5+136 approx.)**

DEPTH (m)	DESCRIPTION	SAMPLE DEPTH (m)	USCS	M.C. (%)
0.0 – 0.1	TOPSOIL/FORREST LITTER			
0.1 – 1.5	Loose to compact (inferred), brown, moist, SAND and GRAVEL (sub-rounded), trace silt; contains occasional cobbles and boulders up to 300 mm diameter - seepage at 1.5 m depth at interface	0.8 – 0.9	GP	5.4
1.5 – 3.0	Firm, grey, wet, silty CLAY; trace fine sand, trace gravel. - at 2.9 m depth, Geonor Vane Shear Test 36 kPa-40 kPa	1.7-1.8 2.9-3.0	CL CL	29.7 40.0
3.0	End of Pit - Vertical walls with some ongoing seepage and sloughing from above 1.5 m depth - Backfilled with excavated materials, topsoil restored and erosion protection installed			

Test Pit located approximately 1.8 m higher and 8 m upslope from centre/base of existing ditch.



**WICK ROAD REALIGNMENT  
TEST PIT LOGS  
NOVEMBER 22, 2016**

**TP16-3 (Sta. 5+100 approx.)**

DEPTH (m)	DESCRIPTION	SAMPLE DEPTH (m)	USCS	M.C. (%)
0.0 – 0.1	TOPSOIL/FORREST LITTER			
0.1 – 0.4	Loose to compact (inferred), brown, wet, SAND and GRAVEL (sub-rounded), trace to some silt; contains occasional cobbles up to 150 mm diameter - seepage above 0.4 m depth	0.2 – 0.3	SM	8.1
0.4 – 2.1	Stiff, brown, wet, silty CLAY; trace fine sand. - at 0.5 m depth, Geonor Vane Shear Test 60 kPa - below 1.2 m depth, grey and contains occasional cobbles. - at 1.2 m depth Geonor Vane Shear Test 80 kPa to 84 kPa - at 1.8 m depth Geonor Vane Shear Test 70 kPa and contains worm burrow traces	0.5 – 0.6 1.2 – 1.4	CL CL	24.7 27.3
2.1 – 2.4	Compact (inferred), grey, moist to wet, silty fine SAND.	2.3 – 2.4	SM	24.6
2.4	End of Pit - Vertical walls with some ongoing seepage and sloughing from above 0.4 m depth - Backfilled with excavated materials, topsoil restored and erosion protection installed			

Test Pit located approximately 1.5 m higher and 5.5 m upslope from centre/base of existing ditch.







## APPENDIX C

### Selected Photos



**Photo 1:** Upper Wick Road looking east from ~Sta. 0+320 (27-May-2016)



**Photo 2:** Undermined asphalt at north shoulder of Wick Road (27-May-2016)





**Photo 3:** Wick Road cracking and subsidence at ~Sta. 0+150 (27-May-2016)



**Photo 4:** Steep embankment slope at Wick Road ~Sta. 0+090 (27-May-2016)



**Photo 5:** Existing Wickaninnish Beach day use parking lot (27-May-2016)



**Photo 6:** Cracking and built up vegetation adjacent to swale (27-May-2016)





**Photo 7:** Localize pot hole adjacent to paving joint (27-May-2016)



**Photo 8:** Kwisis Visitors Centre parking lot – note pot holes (27-May-2016)



**Photo 9:** Localized root damage at day use parking lot (27-May-2016)



**Photo 10:** Undermined trees at Sta. 0+200 Wick Road (27-May-2016)





**Photo 11:** Existing Florencia Bay Parking Lot area (27-May-2016)



**Photo 12:** Florencia Bay Access Road – note unsupported asphalt and cobbly embankment fill materials. (27-May-2016)





**Photo 13:** Florencia Bay Access Road – pull out area (27-May-2016)



**Photo 14:** Florencia Bay Access Road – inadequate shoulder (27-May-2016)



**Photo 15:** Granular veneer and underlying marine clay at TP16-1 (22-Nov-2016)



**Photo 16:** Granular veneer and underlying marine clay at TP16-2 (22-Nov-2016)





**Photo 17:** Marine clay with thin granular veneer at TP16-3 (22-Nov-2016)



**Photo 18:** Typical erosion protection measures during test pitting (22-Nov-2016)





## APPENDIX D

### Laboratory Test Results



SIEVE ANALYSIS REPORT  
 Wick Road Geotechnical Investigation  
 TH16-2, G1, 0.08 - 0.23 m

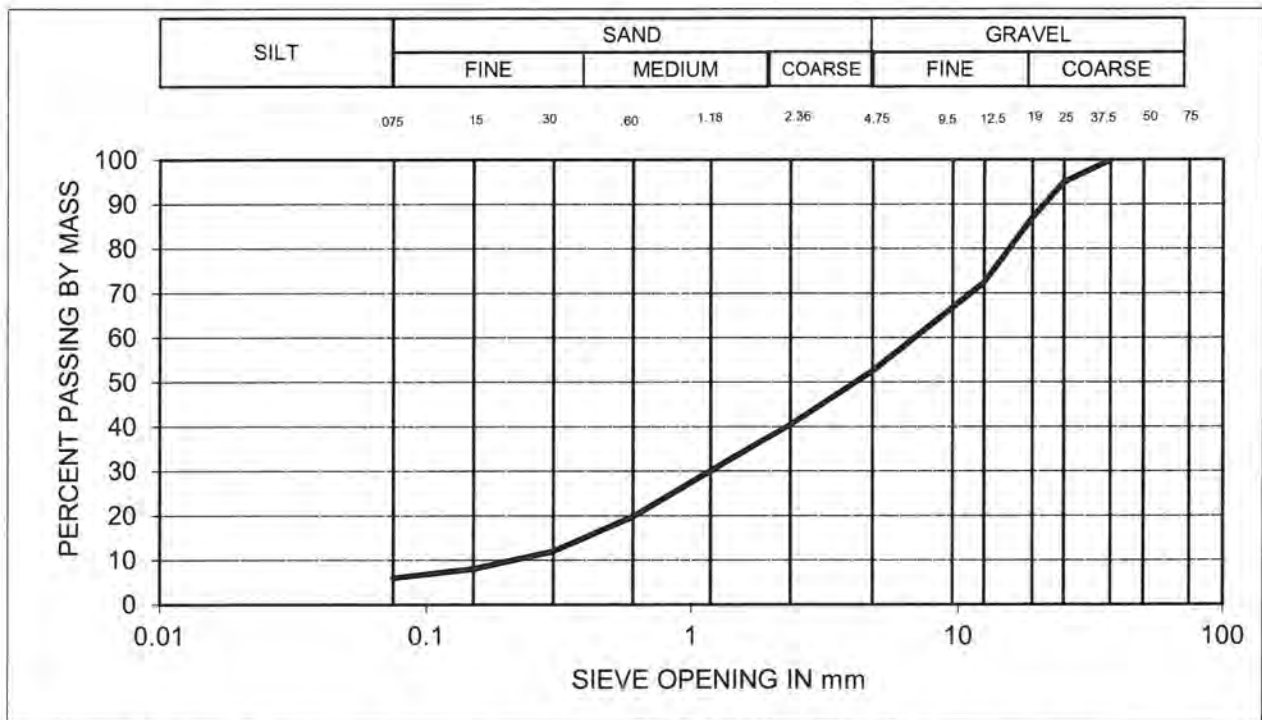
File Number: 12047  
 Date Reported: 22-July-2016

Parsons Corporation

Sampled: 01-June-2016 By: ZRB  
 Received: 6-June-2016 By: AGW  
 Tested: 22-July-2016 By: BRE  
 Checked By: BRE

Sample Source: Test hole  
 Description: SAND and GRAVEL (GW-GM), trace of fines  
 Test Method: ASTM C 136 & C 117

Remarks: Gravel = 47.4 % Sand = 46.6 % Fines = 6.0 %



Gravel Size		Percent Passing	Specifications			Sand Size		Percent Passing	Specifications		
Inches	mm		Upper	Lower	Check	Inches	mm		Upper	Lower	Check
3	75	100				#4	4.75	53			
2	50	100				#8	2.36	40			
1.5	37.5	100				#16	1.18	30			
1	25	95				#30	0.6	20			
.75	19	87				#50	0.3	12			
.5	12.5	73				#100	0.15	8			
.375	9.5	67				#200	0.075	6.0			



SIEVE ANALYSIS REPORT  
 Wick Road Geotechnical Investigation  
 TH16-7, G1, 0.30 - 0.61 m

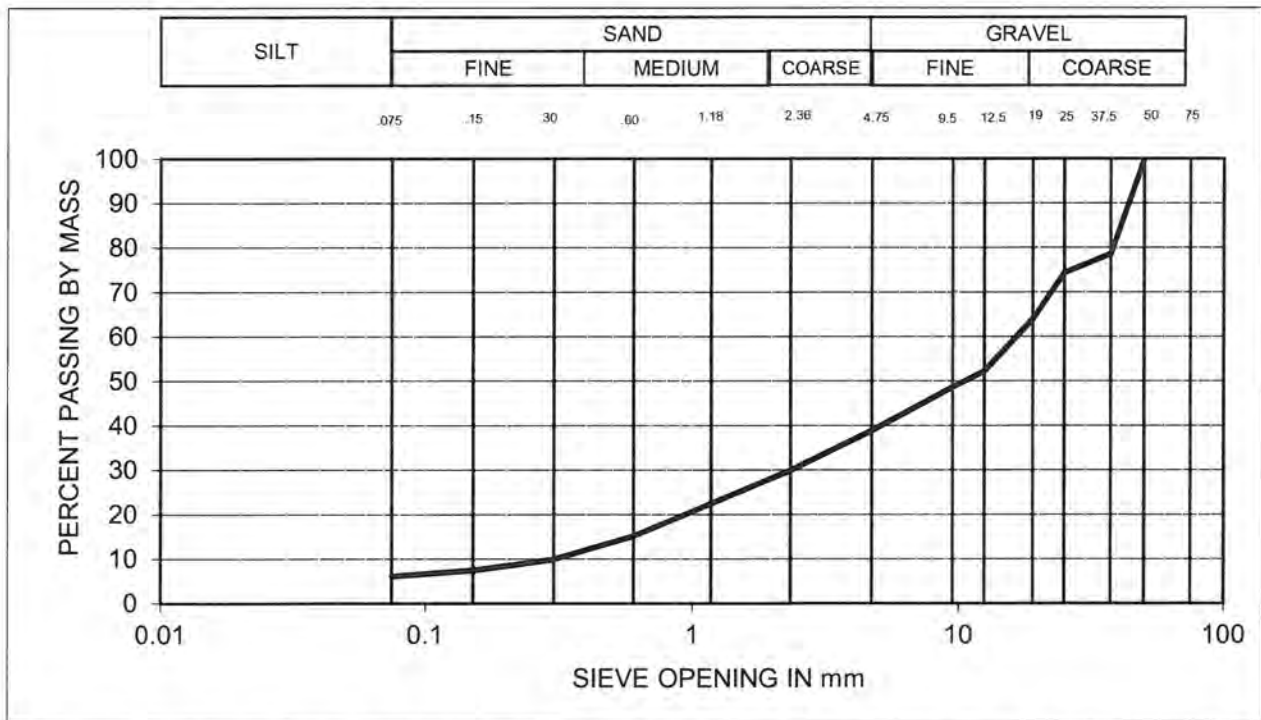
File Number: 12047  
 Date Reported: 22-July-2016

Parsons Corporation

Sampled: 01-June-2016 By: ZRB  
 Received: 6-June-2016 By: AGW  
 Tested: 22-July-2016 By: BRE  
 Checked By: BRE

Sample Source: Test hole  
 Description: sandy GRAVEL (GW-GM), trace of fines  
 Test Method: ASTM C 136 & C 117

Remarks: Gravel = 61.2 % Sand = 32.7 % Fines = 6.1 %



Gravel Size		Percent Passing	Specifications			Sand Size		Percent Passing	Specifications		
Inches	mm		Upper	Lower	Check	Inches	mm		Upper	Lower	Check
3	75	100				#4	4.75	39			
2	50	100				#8	2.36	30			
1.5	37.5	79				#16	1.18	22			
1	25	74				#30	0.6	15			
.75	19	64				#50	0.3	10			
.5	12.5	52				#100	0.15	8			
.375	9.5	49				#200	0.075	6.1			





SIEVE ANALYSIS REPORT  
 Wick Road Geotechnical Investigation  
 TH16-21, G1, 0 - 0.30 m

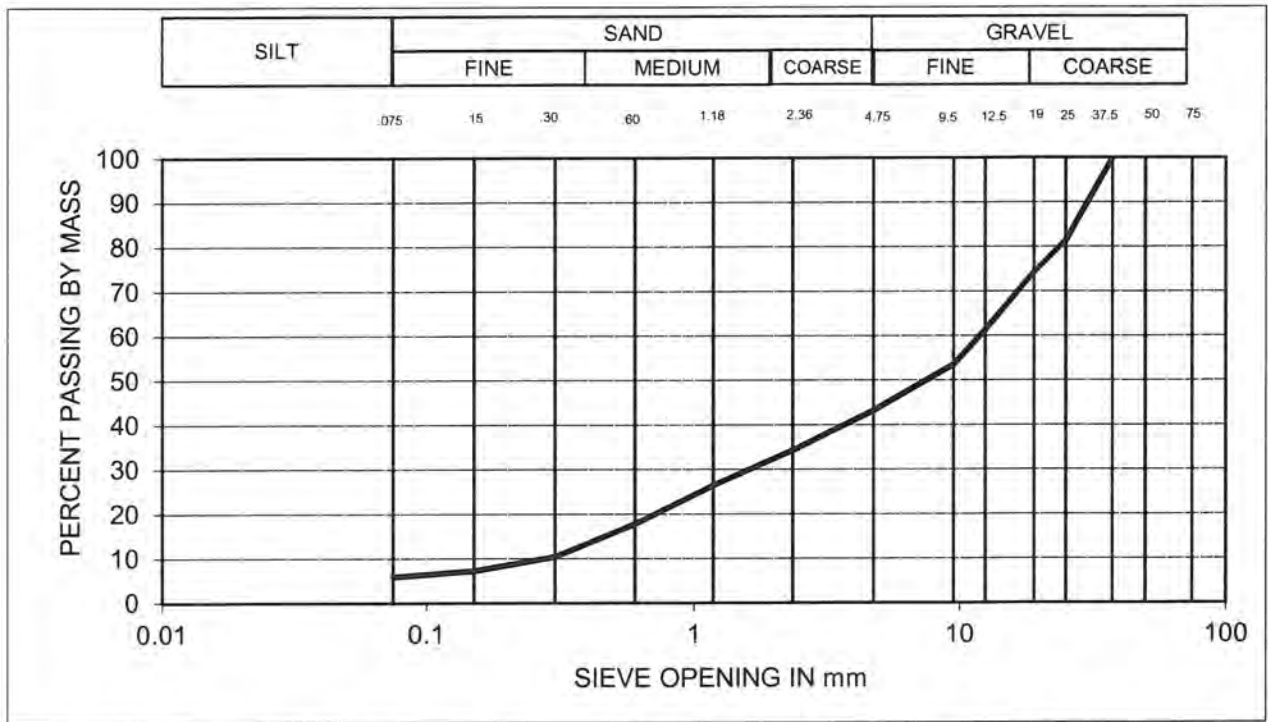
File Number: 12047  
 Date Reported: 22-July-2016

Parsons Corporation

Sampled: 01-June-2016 By: ZRB  
 Received: 6-June-2016 By: AGW  
 Tested: 22-July-2016 By: BRE  
 Checked By: BRE

Sample Source: Test hole  
 Description: SAND and GRAVEL (GP-GM), trace of fines  
 Test Method: ASTM C 136 & C 117

Remarks: Gravel = 56.8 % Sand = 37.3 % Fines = 5.9 %



Gravel Size			Percent Passing	Specifications			Sand Size			Percent Passing	Specifications		
Inches	mm			Upper	Lower	Check	Inches	mm			Upper	Lower	Check
3	75	100				#4	4.75	43					
2	50	100				#8	2.36	34					
1.5	37.5	100				#16	1.18	26					
1	25	81				#30	0.6	18					
.75	19	74				#50	0.3	10					
.5	12.5	61				#100	0.15	7					
.375	9.5	54				#200	0.075	5.9					



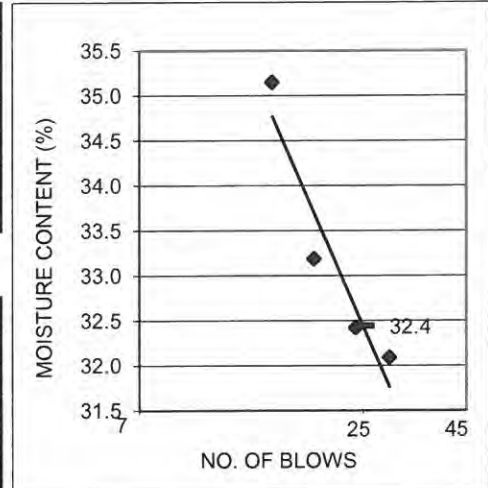


**Liquid Limit, Plastic Limit & Plasticity Index of Soils**  
ASTM D4318

<b>Client:</b>	Parsons	<b>Date Tested:</b>	July 26, 2016
<b>Project:</b>	Wick Road	<b>Tested By:</b>	BRE
<b>Project No:</b>	12047	<b>Checked By:</b>	BRE
<b>Test Hole:</b>	TH16-5	<b>Depth:</b>	18 - 19 ft.
<b>Sample No:</b>	Sa. 6		(5.49 - 5.79 m)

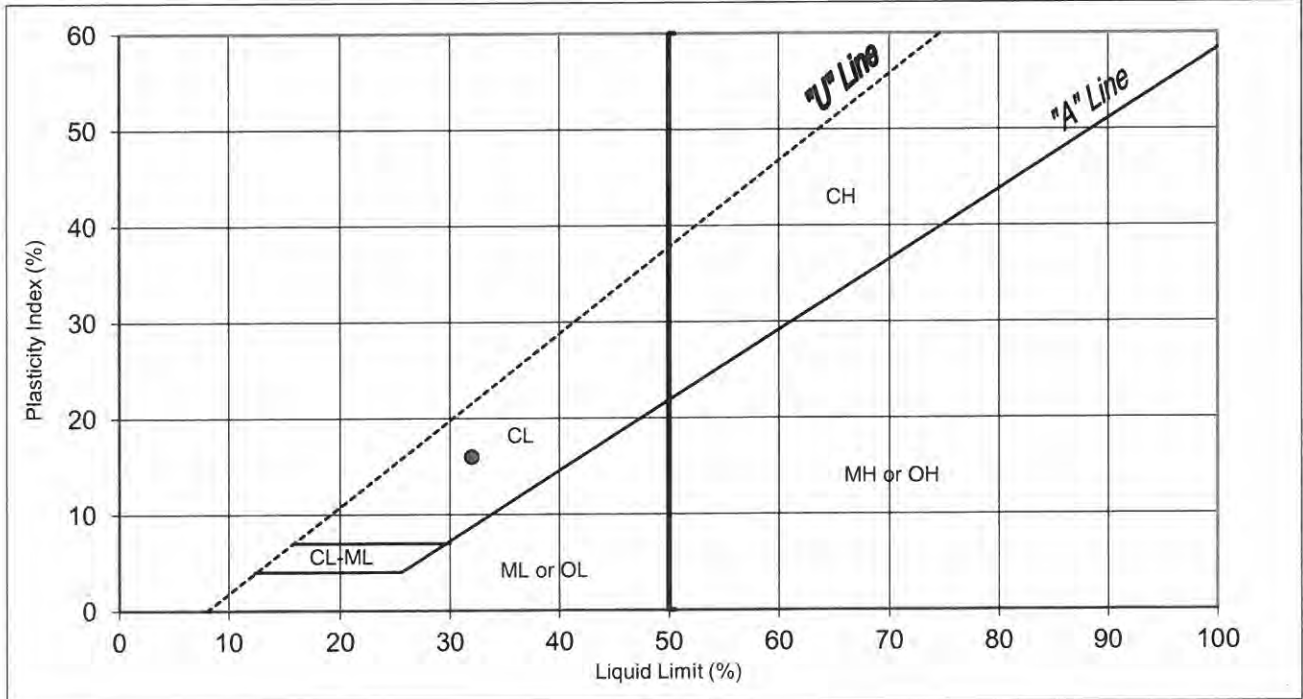
**LIQUID LIMIT**

Trial No:	1	2	3	4
No of Blows:	29	24	19	15
Container No.	645	648	652	658
Wet Soil + Container	36.96	38.20	45.88	42.13
Dry Soil + Container	33.26	34.17	41.32	36.91
Wt. Of Container	21.73	21.74	27.58	22.06
Moisture Content	32.1	32.4	33.2	35.2



**PLASTIC LIMIT**

	1	2	AVERAGE
Container No.	602	619	
Wet Soil + Container	29.98	35.09	
Dry Soil + Container	28.7	33.05	
Wt. Of Container	20.83	20.86	
Moisture Content	16.3	16.7	<b>16.5</b>



**REMARKS**

Material prepared for Atterberg at as received moisture content.

<b>Liquid Limit:</b>	<b>32</b>
<b>Plastic Limit:</b>	<b>16</b>
<b>Plasticity Index:</b>	<b>16</b>
<b>Liquidity Index:</b>	<b>0.5</b>
<b>USC Classification:</b>	<b>CL</b>

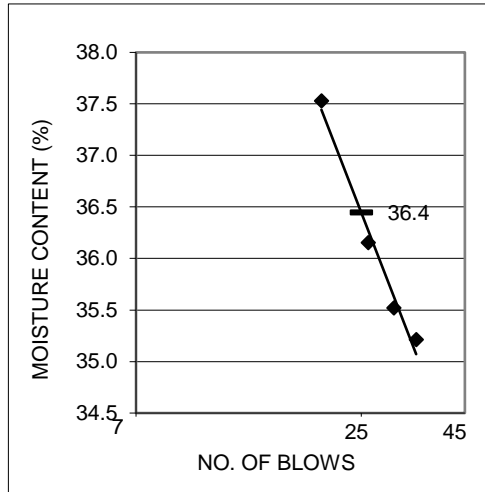


**Liquid Limit, Plastic Limit & Plasticity Index of Soils**  
ASTM D4318

<b>Client:</b>	Parsons	<b>Date Tested:</b>	Nov. 25, 2016
<b>Project:</b>	Wick Road & Kwisitis Parking Lot Upgrades	<b>Tested By:</b>	AGW
<b>Project No:</b>	12047	<b>Checked By:</b>	BRE
<b>Test Hole:</b>	TP16-2	Depth: 9.5 - 10.0 ft.	
<b>Sample No:</b>	3	(2.90 - 3.05 m)	

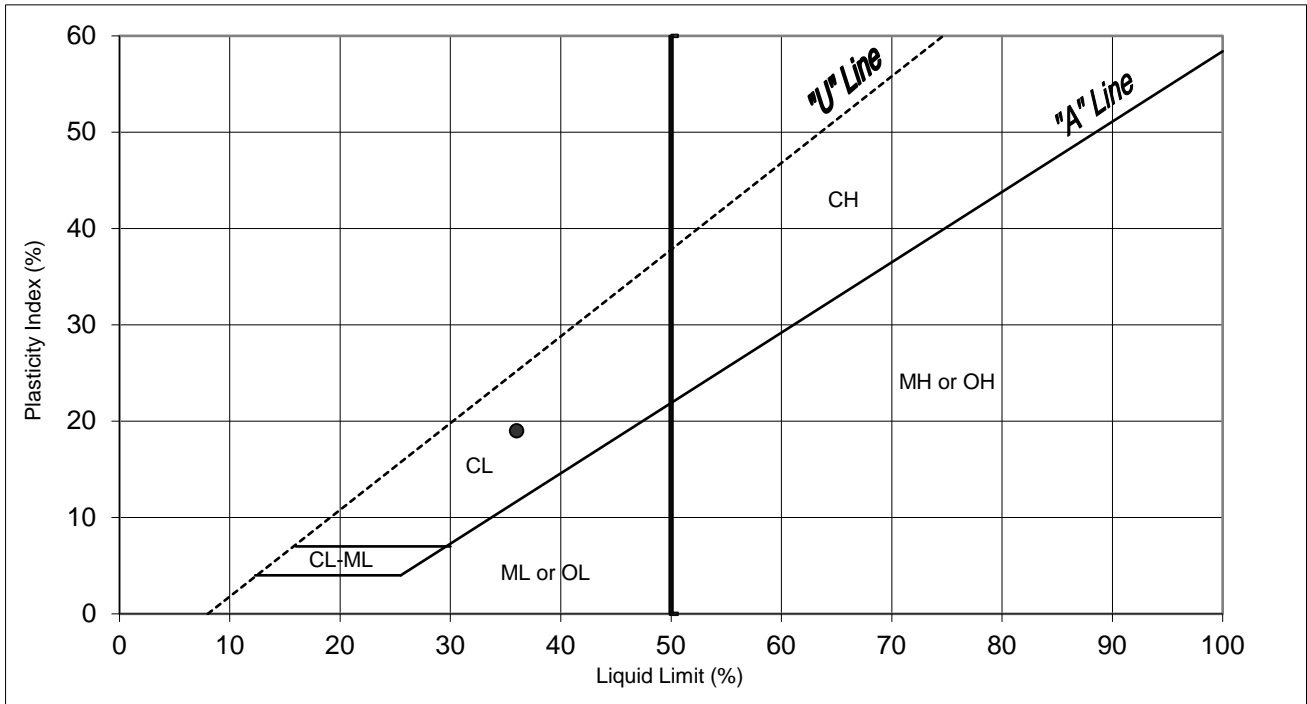
**LIQUID LIMIT**

Trial No:	1	2	3	4
No of Blows:	34	30	26	20
Container No.	658	654	657	652
Wet Soil + Container	37.89	44.98	38.73	45.84
Dry Soil + Container	33.77	40.38	34.20	40.86
Wt. Of Container	22.07	27.43	21.67	27.59
Moisture Content	35.2	35.5	36.2	37.5



**PLASTIC LIMIT**

	1	2	<b>AVERAGE</b>
Container No.	653	642	
Wet Soil + Container	37.88	31.07	
Dry Soil + Container	36.37	29.65	
Wt. Of Container	27.46	21.37	
Moisture Content	16.9	17.1	<b>17.0</b>



**REMARKS**

Material prepared at "as received" moisture content.  
As received moisture content = 24.7%.

<b>Liquid Limit:</b>	<b>36</b>
<b>Plastic Limit:</b>	<b>17</b>
<b>Plasticity Index:</b>	<b>19</b>
<b>Liquidity Index:</b>	<b>0.4</b>
<b>USC Classification:</b>	<b>CL</b>

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**PWGSC**

Pacific Traverse Trail Clearing  
Pacific Rim National Park Reserve, BC  
Project No. R.089036.001

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**APPENDIX B**

**Appendix B**  
**Environmental Management Plan**  
**Wick Road and Kwisitis Visitor Centre**  
**Parking Lot Upgrades**

Current Environmental  
January 25, 2017

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# ENVIRONMENTAL MANAGEMENT PLAN

WICK ROAD AND KWISITIS VISITOR CENTRE PARKING LOT UPGRADES  
PACIFIC RIM NATIONAL PARK RESERVE



*January 25th, 2017*

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## 1 INTRODUCTION

This Environmental Management Plan (EMP) is intended to be used by the prospective project Contractor (the Contractor) in order to understand the environmental performance standards and responsibilities expected of the Contractor in executing the *Wick Road and Kwisitit Visitor Centre Parking Lot Upgrades Project* (the Project). This EMP will also be used by Parks Canada Agency (PCA) and Public Works and Government Services Canada (PWGSC), and all other personnel providing environmental oversight on the Project. This includes Parks Canada Wardens, the Environmental Coordinator (EC) from PWGSC, and the Owner's Environmental Monitor (OEM).

The Contractor must review this report and ensure that their bid accounts for all of the environmental requirements described in the various sections below. The following sections describe the key environmental aspects of the project, roles and responsibilities, and the anticipated mitigation measures that will be required throughout construction. The environmental protection measures described in this report were developed based on PCA standards and practices, past project experience, and current industry best management practices. This EMP should be considered a "living document" whereby revisions and updates are made interactively as the Project progresses.

### **Note to prospective Contractors:**

Due to the significant environmental requirements of this project, the environmental monitoring component will be provided directly by Public Works and Government Services Canada (PWGSC) (the Owner) in the form of an Owner's Environmental Monitor (OEM). The OEM will be onsite at all times during construction near environmentally sensitive areas, and will have the authority to direct the Contractor with regards to installing mitigation measures and ensuring that appropriate measures are followed. The OEM will also have the authority to shut down construction during heavy rainfall events that preclude effective environmental mitigation.

The Contractor will therefore not be required to hire a separate Environmental Monitor for this project, however, they will still be responsible for purchasing and effectively installing all of the mitigation measures described in this EMP. The Contractor will be compensated for mitigation measures installed based on Section 01 35 43 - Environmental Procedures in the Contract Documents.

It is imperative that this EMP be **read in full** by the Contractor before bidding for this contract.

### **1.1 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT PLAN**

The purpose of this Environmental Management Plan (EMP) is to:

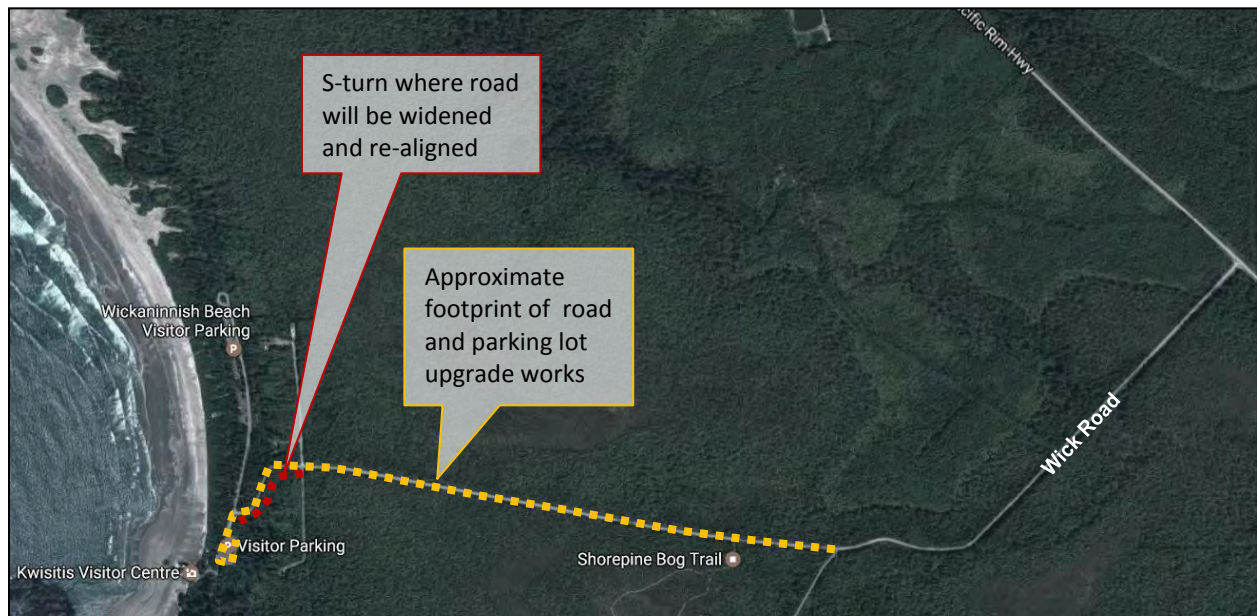
- 1) Identify and summarize the key environmental concerns relating to the Project including Valued Ecosystem Components (VECs) within or near the project areas;
- 2) Summarize the overarching regulatory requirements that apply to this Project within Pacific Rim National Park Reserve;
- 3) Clearly identify the Project roles/responsibilities with regards to environmental aspects of the Project so that all prospective Contractors are aware of the requirements;



- 4) Provide mitigation measures and response plans related to the various Project components that will minimize risk to identified VECs. These measures will set the expectation for what is required during construction.

## 1.2 PROJECT LOCATION

This phase of work will occur along Wick Road and at the Kwisisit Visitor Centre Parking Lot within Pacific Rim National Park Reserve on the west coast of Vancouver Island, BC (Figure 1). Wick Road is located between the communities of Tofino and Ucluelet, approximately 5 km northwest of the Highway 4 Junction. The work along Wick Road is limited to the area between the turnoff to the Florencia Bay Access Road and the day use parking lots at the western end of Wick Road.



**Figure 1.** Project location with the approximate footprint of the road and parking lot upgrade works shown in yellow and the S-turn where the road will be widened and re-aligned shown in red. (Map source: Google Maps, 2016).

## 1.3 DESCRIPTION OF WORKS

### 1.3.1 Wick Road and Kwisisit Visitors Centre Parking Lot Upgrades

The Project works will include resurfacing and restoring Wick Road between the Florencia Bay Access Road turnoff and the Kwisisit Visitors Centre Parking Lot at the western end of the road. Project works will also include resurfacing and upgrading the Kwisisit Visitor Centre Parking Lot at the end of Wick Road, however the Wickaninnish Beach Visitor Parking Lot will not be included in this scope of work.

As part of the road upgrading work, Wick Road will be widened and re-aligned along the S-Curve between Ocean Terrace Road and the road junction at the Kwisisit Visitor Centre Parking Lot and Wickaninnish Beach Visitor Parking Lot (see S-Turn label on Figure 1). Clearing of trees will be required along a portion of the S-turn to allow for the widening and re-alignment, however the mature stand of Sitka spruce trees located on the slope to the west of the S-turn will be left undisturbed. The extent of tree clearing will be limited to a cluster of trees immediately north of the S-curve and adjacent to Ocean Terrace Road, and immediately southeast of the S-curve



on the uphill slope where the overall age of the forest is less and the sensitivity is lower. The purpose for widening the road along this S-turn is to accommodate a section of the Pacific Traverse Trail (PTT) in the future, and to improve road visibility and safety along this curve.

Resurfacing and road/parking lot upgrade work will involve re-grading the road shoulder to the desired 2:1 slope, stripping existing pavement and road materials down to structurally sound material, and replacing with engineered backfill and geogrid for paving. After re-grading the banks of the roadside ditches, all exposed areas above High Water Mark will be covered with natural coco-matting Erosion Control Blankets as described in the Contract Documents to minimize the release of sediments into watercourses. The finished elevation of Wick Road will also be raised in two areas where flooding has occurred in the past. Overall, the existing width of Wick Road and the location of the roadside ditches will be maintained, except at the S-curve as described above.

At the base of the S-curve where Wick Road ends, there will also be 3 culvert replacements in the roadside drainage ditches that outlet to the ocean. These drainages are not considered fish bearing owing to the steep gradient and intermittent flows, however it will still be important to follow appropriate mitigation measures (described in this report) while replacing these culverts in order to minimize the impacts to potential amphibian habitat and sensitive marine shoreline habitat downstream. In addition to these 3 culverts, there are several other culverts further east on Wick Road that will be upgraded as part of this project that involve potential fish bearing watercourses. These more sensitive culvert upgrades are described below.

### 1.3.2 Culvert Upgrades

There are 5 culverts located on the straight stretch of Wick Road between the Shorepine Bog Walk Parking Lot and Ocean Terrace Road (Culvert 44, 45, 46, 47, and 48 on the Design Drawings)(See Figure 3 in Section 3). Culvert 44 and 45, furthest east, have a diameter of 450 mm, and Culvert 46, 47, and 48, further west, have a diameter of 600 mm. There is also a 300 mm diameter culvert (Culvert 6) that crosses the entrance to the Shorepine Bog Walk Parking Lot. These culverts, all corrugated HDPE, are in good shape and will remain in place, however there will be pre-cast concrete headwalls added to the inlet and outlet of each of these culverts to provide more stability to the existing culverts and in order to prevent the inlets and outlets from overgrowing with vegetation.

In addition to the installation of concrete headwalls, there will be a second 450 mm corrugated HDPE culvert installed parallel to the existing Culvert 45 with matching concrete headwalls which will help to alleviate issues with flooding on this portion of the road and to further ensure that the hydrology between the bogs to the north and south of Wick Road remains balanced.

As **fish presence is possible throughout all of these watercourses**, fish passage criteria has been considered as part of the culvert upgrading work<sup>1</sup>. All of the culverts are currently installed at a gradient of less than 1% and the new headwalls will be partially embedded with the existing native materials to facilitate fish passage. The Owner's Environmental Monitor and the Departmental Representative will work with the Contractor on site to further ensure that the headwalls are installed according to fish passage criteria during construction. With regards to the addition of a second culvert at Culvert 45, it is typically preferential to install one culvert lower than the other to facilitate low flow fish passage, however with the limited depth of road at this location, it was not possible to adjust the location of the new culvert invert. However, despite the culverts being installed at the same elevation,

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<sup>1</sup> BC Ministry of Transportation and Infrastructure. 2013. Culverts and Fish Passage Information Sheet. Accessed from <[http://www.th.gov.bc.ca/publications/eng\\_publications/environment/references/3824\\_CulvertFishPassage\\_InfoSheet.pdf](http://www.th.gov.bc.ca/publications/eng_publications/environment/references/3824_CulvertFishPassage_InfoSheet.pdf)>.

fish passage will still be possible at this location owing to the unique hydrology in this area where the water level on either side of Culvert 45 equalizes with the rising water level in the bogs resulting in a water depth sufficient for fish passage.

Finally, the installation of these culverts will require heightened mitigation measures to ensure that there is no impact to fish and amphibian habitat during construction. Some of the key mitigation measures will involve fish salvage, amphibian salvage, installation of coco-matting along exposed banks, implementing water diversion measures when completing the culvert work, and factoring in delays during large rainfall events. The complete list of expectations regarding mitigation measures is outlined in Section 8 of this EMP.

## 2 KEY ENVIRONMENTAL COMPONENTS

Table 1 summarizes the key environmental concerns of the project. A detailed description of the Valued Ecosystem Components involved in this project is provided in Section 3 below.

Table 1. Key environmental concerns associated with the proposed works in Pacific Rim National Park.

Environmental Concern	Comments
Damage to aquatic habitat	Watercourses, riparian areas, and wetlands occur in the area where works will occur. Of particular note is the <b>sensitive bog habitat</b> located immediately adjacent to Wick Road between the Florencia Bay Access Road and Ocean Terrace Road. Also of note are the <b>watercourses</b> and road drainage areas that flow through culverts under Wick Road. While these watercourses are relatively small and have low velocity, they must still be considered potential fish habitat and potential amphibian breeding areas. See Figure 2 and Section 3.1 for details.
Damage to terrestrial habitat	Important terrestrial habitat that occurs within the project footprint includes avian nesting sites, mature trees, and wildlife corridors. See Figure 2 and Section 3.2 for details.
Impact to species at risk	A number of species at risk have the potential to occur within the project footprint. See Section 3.3 and Appendix C for details.
Introduction of Invasive Species	There are a number of invasive species that have the potential to occur within the project footprint (See Appendix D). It is imperative that heightened measures be taken during construction to prevent the introduction or spread of invasive species within Pacific Rim National Park Reserve, especially during clearing and grubbing, and when hauling in new road materials.



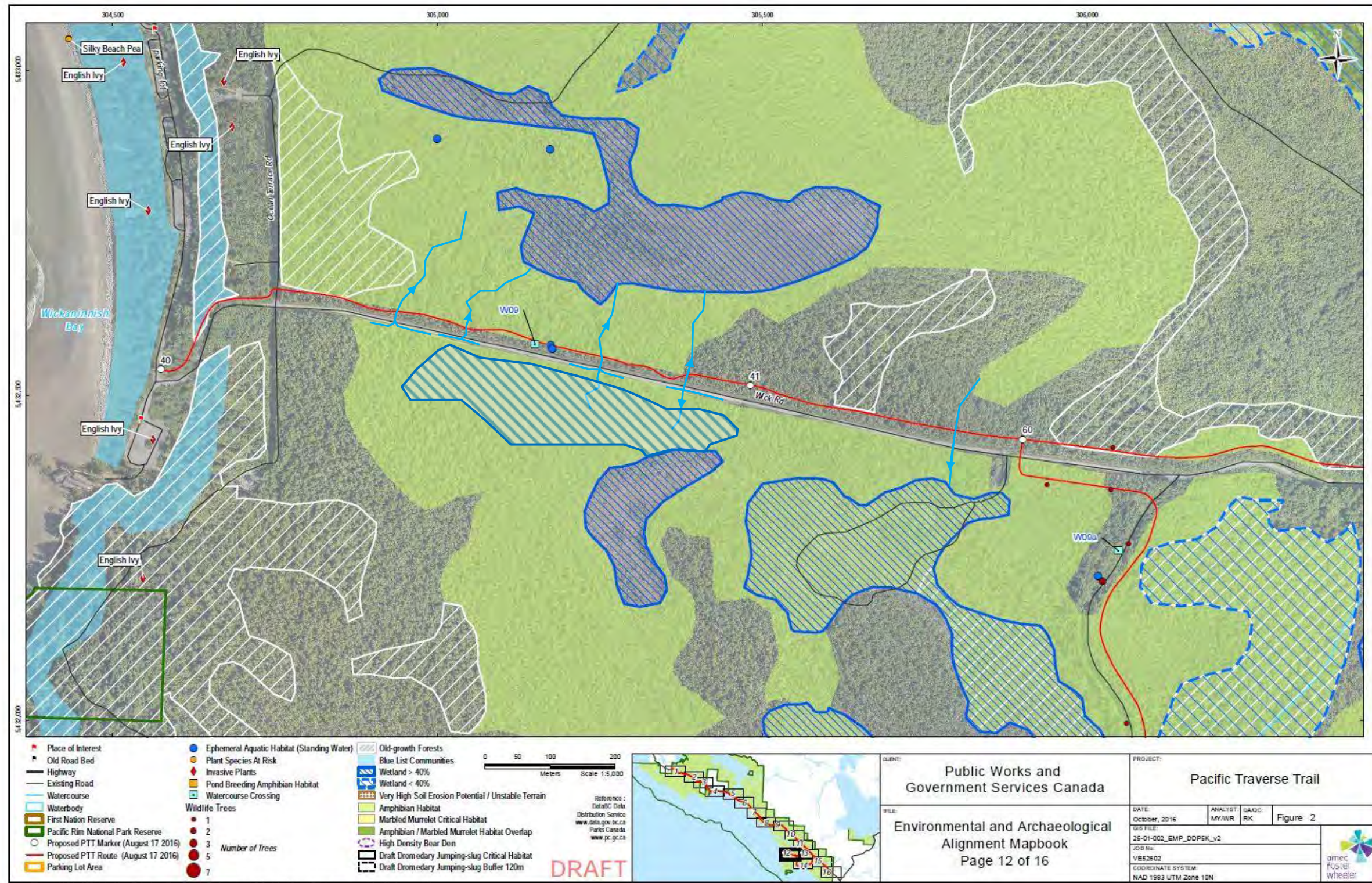


Figure 2. Map of the project area showing known occurrences of sensitive environmental features near the proposed works in Pacific Rim National Park. Note that the trail alignment as shown on this map is not accurate and the ditches along Wick Road are under-represented. (Adapted from Amec Foster Wheeler, 2016)



### 3 VALUED ECOSYSTEM COMPONENTS

The following sub-sections describe any Valued Ecosystem Components (VECs) within or near the project areas. The term Valued Ecosystem Component is adapted from the *Canadian Environmental Assessment Act*<sup>2</sup> and for the purposes of this EMP, will include any environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance.



#### 3.1 AQUATIC HABITAT

There are several watercourses, ditches, and wetlands identified within the project footprint. According to the available topography and contour mapping for this area, there is a plateau of land between the Florencia Bay Access Road and the lower sections of Wick Road which creates a small watershed divide in this area; a portion of the area drains towards Sandhill Creek, an important salmon creek, and the other portion of the project area drains towards the ocean at Wickaninnish Beach (location of culverts and flow direction identified in Figure 3). Table 2 describes the types of aquatic habitat with the potential to be impacted by this project.

Table 2. Summary of the key aquatic habitat components within the project footprint.

Aquatic Habitat	Comments
<p>Watercourses</p>	<p>There are several low gradient watercourses that flow through existing culverts under Wick Road within the project footprint (Photo 1). The location of these watercourse crossings are identified in Figure 3. These watercourses connect to the wetlands/bogs on either side of Wick Road, and eventually flow into Sandhill Creek or towards the ocean at Wickaninnish Beach. When water levels are high during the winter months, all of these watercourses connect to fish habitat, therefore <b>they are all considered possible fish bearing watercourses</b> and should be dealt with as such. There is also potential amphibian breeding in the low gradient portions of these watercourses.</p> <div> </div> <p>Photo 1. One of the culvert crossings along the straight stretch of Wick Road showing the low gradient channel form in the roadside ditches and watercourses. The photo on the left was taken in June 2016 and the photo on the right was taken in January 2017 which shows the range of water levels in these watercourses. The Contractor will need to be prepared for varying water levels during construction as heavy rainfall events can occur at any time of the year in this region.</p>

<sup>2</sup> Canadian Environmental Assessment Agency. 2016. *Canadian Environmental Assessment Act, Glossary, Part 2. Explanation of Terms, Valued Ecosystem Component*. <http://www.ceaa.gc.ca/default.asp?lang=En&n=B7CA7139-1&offset=3#v>

<p><b>Roadside ditches and seasonally wetted depressions</b></p>	<p>There are numerous seasonally wetted/ephemeral ditches and depressions immediately adjacent to Wick Road between the culvert crossings described above (Photo 2). The majority of these ditches are dry during the summer months (June-August), however there are some isolated pools that remain year-round. During the wet winter months, these ditches flow into the watercourses described above. There are also some seasonally wetted ditches and depressions surrounding the parking lot at the Kwisitis Visitors Centre. All of these wetted areas provide breeding habitat for amphibians, and potential rearing areas for fish during the winter months.</p>  <p><b>Photo 2. Typical segment of ditch along the straight stretch of Wick Road. The photo on the left was taken in June 2016 and the photo on the right was taken in January 2017.</b></p>
<p><b>Wetlands (bogs)</b></p>	<p>The project location is surrounded by several valuable wetlands classified as bogs based on the vegetation communities and accumulation of peat; primarily sphagnum moss. The dominant tree species in these bogs are shorepines which are stunted in their growth as a result of the harsh growing conditions (Photo 3). While these bogs are not officially provincially or federally protected ecosystems, these unique habitats in the park are ancient natural ecosystems that are recognized by the Pacific Rim National Park Reserve as ecosystems that must be preserved and protected.</p> <p>These bogs rely on the saturation of soils and a high water table for the specialist plants in this ecosystem to thrive. <b>Any modification to the water balance surrounding these bogs could permanently alter the proper functioning of these ecosystems, and could lead to plant and tree mortality.</b> Care should be taken during construction along Wick Road, especially with regards to culvert upgrades, to maintain the water balance surrounding these features, and to ensure that no sediment laden water or toxins are released into this environment. Also of note is the important amphibian habitat within these bogs.</p>  <p><b>Photo 3. Typical section of bog located along Wick Road. Photo taken from the Shorepine Bog boardwalk.</b></p>



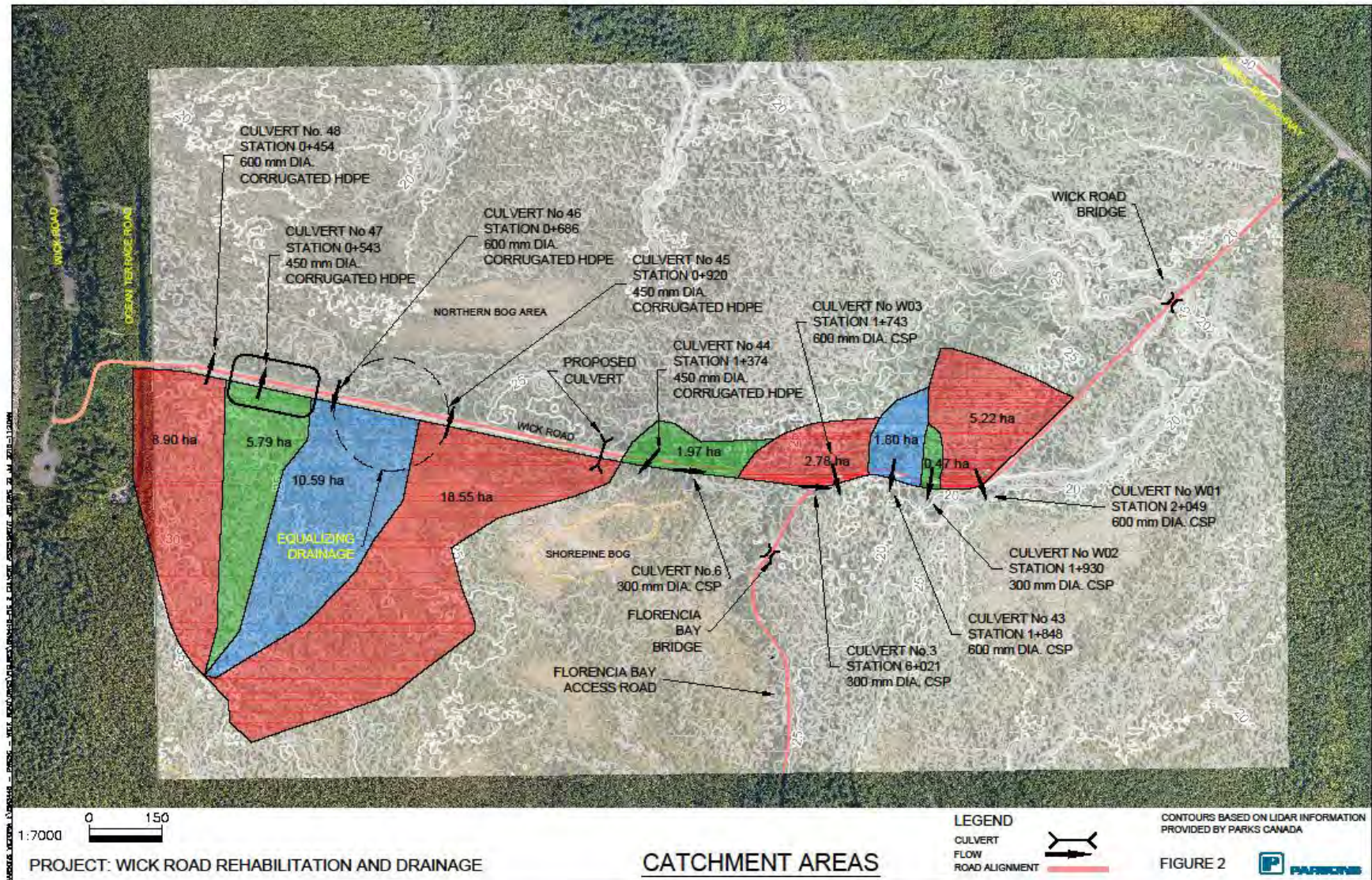


Figure 3. Overview of catchment areas at the project location. Note that the location of the proposed culvert in this figure has been changed to be adjacent to Culvert 45. (Parsons 2016)




### 3.2 TERRESTRIAL HABITAT

The key terrestrial Valued Ecosystem Components (VECs) within the project footprint include avian nesting habitat, mature trees, and wildlife corridors. These VECs are described in Table 3 below.

Table 3. Summary of the key terrestrial habitat components surrounding the project areas.

Terrestrial Habitat	Comments
<p><b>Avian nesting habitat</b></p>	<p>There are no known Bald Eagle nests, Great Blue Heron nests, or any other raptor nests located within 200 m of the project footprint. However, with mature forest and mature shorepine bog habitat surrounding the Project areas, there is a moderate to high likelihood of migratory birds using these areas for nesting in the spring. There is also a possibility of owls, other cavity nesting birds, and bats using some of the snags (dead or dying trees) in the forest adjacent to the worksite for nesting as well.</p> <p><b>The Environment Canada migratory bird nesting window for Nesting Zone A (Northern Pacific Rainforest - BCR5) is between March 12th and August 17th.</b> With mature trees, it is difficult to complete accurate pre-clearing nest surveys during the migratory bird nesting window, therefore <b>the clearing for this contract should be scheduled to be outside of this nesting window.</b></p> <p>If any clearing, grubbing, or falling of danger trees must occur within the migratory bird nesting window then a thorough pre-clearing nest survey will need to be completed by the Owner's Environmental Monitor (OEM) to identify any active nests.</p>
<p><b>Mature trees</b></p>	<p>Vegetation surrounding the project areas consist primarily of mature forest with a canopy of western red cedar, Sitka spruce, western hemlock, Douglas fir, and red alder, with other areas dominated by shorepine bog habitat. All of these mature trees provide potential avian nesting habitat as described above, and also contribute shade, nutrients, and shelter as part of functioning forest ecosystems.</p> <p>All trees outside of the clearing limit will need to be protected during construction, however there is one tree community that is of particular importance: the <b>spruce fringe</b>. The spruce fringe refers to the band of mature Sitka spruce trees that grow adjacent to the marine shoreline on the west coast of Vancouver Island between the ocean and the rest of the forest. Sitka spruce trees have adapted to survive in harsh conditions along the west coast where they are exposed to the full impacts and salt spray from southeasterly winter storms. The spruce fringe acts as a barrier that protects the rest of the forest from these harsh conditions. Removal of trees from the spruce fringe can result in additional tree mortality as other species are newly exposed to the harsh marine shoreline conditions. A portion of the spruce fringe is present immediately adjacent Wick Road on the west side of the sharp "S-turn" heading down towards the ocean (Photo 4); particular care must be taken during construction to avoid any damage to these trees.</p>

	 <p><b>Photo 4. Looking downhill towards the ocean along the "S-turn" on Wick Road showing mature spruce trees along the right hand side of the road.</b></p>
<p><b>Wildlife corridors</b></p>	<p>One of the most active wildlife corridors in all of Pacific Rim National Park Reserve intercepts the Project location near the junction of Wick Road and Ocean Terrace Road. Based on local knowledge and information obtained from Pacific Rim National Park Reserve staff, animals such as wolves, cougars, and black bears all use this wildlife corridor regularly as they pass from Wickaninnish Beach to Florencia Bay through the open shorepine bog habitats. Certain precautions (outlined in the mitigation section of this report) must be taken by the Contractor to avoid any disruption of wildlife during construction.</p>

### 3.3 SPECIES AT RISK

Based on the habitat observed at the project location, it is possible that the following Species at Risk (federal and/or provincial) utilize the habitat surrounding the Project:

1. Northern red-legged frog (*Rana aurora*)
2. Western Toad (*Anaxyrus boreas*)
3. Wandering Salamander (*Aneides vagrans*)
4. Olive-sided Flycatcher (*Contopus cooperi*)
5. Band-tailed Pigeon (*Patagioenas fasciata*)
6. Common Nighthawk (*Chordeiles minor*)
7. Marbled Murrelet (*Brachyramphus marmoratus*)
8. Northern Goshawk, *laingi* subspecies (*Accipiter gentilis laingi*)
9. Northern Pygmy-Owl, *swarthy* subspecies (*Glaucidium gnoma swarthy*)
10. Western Screech-owl, *kennicottii* subspecies (*Megascops kennicottii kennicottii*)
11. Cutthroat trout, *clarkia* subspecies (*Oncorhynchus clarkii clarkii*)
12. American water shrew, *brooksi* subspecies (*Sorex palustris brooksi*)
13. Ermine, *anguinae* subspecies (*Mustela erminea anguinae*)
14. Keen's myotis (*Myotis keenii*)
15. Little brown myotis (*Myotis lucifugus*)
16. Townsend's big-eared bat (*Corynorhinus townsendii*)
17. Dromedary jumping-slug (*Hemphillia dromedarius*)
18. Warty jumping-slug (*Hemphillia glandulosa*)
19. Edward's beach moth (*Anarta edwardsii*)
20. Sand-verbena moth (*Copablepharon fuscum*)



21. Seaside centipede lichen (*Heterodermia sitchensis*)
22. California wax-myrtle (*Myrica californica*)
23. Oregon ash (*Fraxinus latifolia*)

Species summaries for these animals are presented in Appendix C . Mitigation measures and construction Best Management Practices provided in Section 8 generally account for the protection of these species. Project-specific measures should be provided in more detail once construction plans are finalized.

## 4 REGULATORY REQUIREMENTS

In managing national parks, Parks Canada is mandated to protect the overall ecological integrity of the federal park system<sup>3</sup>. As such, the protection of Valued Ecosystem Components (VECs) and the mitigation of environmental impacts are to be of primary importance during construction of the Project. There are several federal regulations that govern construction activities in proximity to VECs. These include:

1. Canada *National Parks Act* and Regulations (CNPA).
2. Department of Fisheries and Oceans *Fisheries Act* 2012
3. Canada *Species at Risk Act* (SARA)
4. *Migratory Bird Convention Act*
5. *BC Water Sustainability Act*<sup>4</sup>

If implemented correctly, the Best Management Practices (BMPs) and mitigation measures outlined in this document will ensure the protection of VECs and compliance with the abovementioned regulations.

### 4.1 CANADA NATIONAL PARKS ACT AND REGULATIONS (CNPA).

The following selected sections of the CNPA and regulations are relevant to the proposed work and must be adhered to:

#### 4.1.1 Canada *National Parks Act*

Section 10. No person shall remove, deface, damage or destroy any flora or natural objects in a Park except in accordance with a permit issued under subsection 11(1) or 12(1).

Section 16. No person shall pollute any watercourse.

Section 17. No person shall obstruct or divert, by means of a pipe or otherwise, any watercourse, except as authorized by a permit issued by a superintendent.

#### 4.1.2 National Park Wildlife Regulations

Section 4. (1) Except as otherwise provided in these Regulations, no person shall:

- a. (A) hunt, disturb, hold in captivity or destroy any wildlife within, or remove any wildlife from, a park;

<sup>3</sup> Parks Canada's Departmental Performance Report 2011-12.

<sup>4</sup> Provincial regulations do not have jurisdiction in federal lands, however the *Water Act* and Section 9 documents specific to Works in and About a Stream are referenced as they provide good, detailed information on the mitigation of impacts in aquatic habitats.

- b. (C) in any park other than a park referred to in paragraph (B), or outside a park, be in possession of any wildlife killed or procured within a park, unless the wildlife is in that person's possession in accordance with subsection (4);
  - c. (E) disturb or destroy a nest, lair, den or beaver house or dam in a park;
  - d. (F) touch or feed wildlife in a park or entice wildlife that is in a park to approach by holding out or setting out decoys or any such devices, foodstuffs or bait of any kind; or
  - e. (G) release any exotic wildlife within a park.
- (2) No person shall shine a movable light having a voltage greater than 4.5 volts in any area frequented by wildlife between sunset and sunrise.

### 4.1.3 Section 32 - Mitigation of Environmental Damage

#### 4.1.3.1 Pollution clean-up

32. (1) Where a substance that is capable of degrading the natural environment, injuring fauna, flora or cultural resources or endangering human health is discharged or deposited in a park, any person who has charge, management or control of the substance shall take reasonable measures to prevent any degradation of the natural environment and any danger to the fauna, flora or cultural resources or to persons that may result from the discharge or deposit.

#### 4.1.4 Powers of Superintendent and Minister

32.(2) If the superintendent of a park is of the opinion that a person is not taking the measures required by subsection (1), the superintendent may direct the person to take those measures and, if the person fails to do so, the Minister may direct those measures to be taken on behalf of Her Majesty in right of Canada.

## 4.2 DFO FISHERIES ACT (2012)

The *Fisheries Act* was amended on June 29, 2012. As of November 25, 2013 the new fisheries protection provisions of the Act came into force. The Fisheries Protection Policy describes the changes to the *Fisheries Act* made in 2012. The focus is now on the productivity of commercial, recreational and Aboriginal fisheries; the establishment of enhanced compliance and protection tools that facilitate enforcement; provide clarity, certainty and consistency of regulatory requirements; and enable enhanced partnerships with other agencies of government and local groups to ensure a comprehensive approach to fisheries protection. The changes include:

1. A prohibition against causing serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery (Section 35);
2. A prohibition against depositing or permitting the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water (Section 36(3));
3. Provisions for flow and passage (Section 20 and 21);
4. A framework for regulatory decision-making (Section 6 and 6.1).

These provisions are intended to reduce threats to habitat (degradation or loss), flow alteration, aquatic invasive species, overexploitation of fish, and pollution of many kinds that may adversely affect water quality and fish health.

When conducting a project near water, it is the responsibility of the person or proponent conducting the work to ensure they are avoiding causing *serious harm to fish* in compliance with the Fisheries Act. The DFO document entitled "*Measures to Avoid Causing Harm to Fish and Fish Habitat*" applies to all project types and replaces all previous DFO "*Operational Statements*".

#### 4.2.1 Self-Review under the 2012 Fisheries Act

Under the revised *Fisheries Act*, projects may either be submitted for review to DFO agency staff ("Request for Review" process) or "Self-Assessed" by a Qualified Environmental Professional (QEP). While the final design drawings had yet to be accepted at the time that this EMP was written, it is our understanding that the culvert upgrades along Wick Road will involve an increase in the footprint below High Water Mark through the addition of pre-cast concrete headwalls. With these watercourses being potentially fish-bearing, and the scope of the proposed culvert upgrades going beyond "replacement" and "regular maintenance", a Request for Review (RFR) will be submitted for this project. This RFR will be submitted by the Owner's Environmental Monitor (OEM) once the final design drawings are submitted. Should the Project scope change, the DFO Self-review will be conducted again by the OEM prior to starting work to determine whether or not the Project will require a review.

### 4.3 SPECIES AT RISK ACT

The *Species at Risk Act* (SARA) is a federal law with three main goals:

1. Prevent endangered or threatened species from becoming extinct or extirpated;
2. Help in the recovery of endangered, threatened and extirpated species; and
3. Manage species of special concern to help prevent them from becoming endangered or threatened.

For those species listed as extirpated, endangered or threatened under the *Species at Risk Act* (SARA), it is illegal to:

1. Kill, harm, harass, capture or take an individual;
2. Possess, collect, buy, sell or trade an individual or any part of an individual; and
3. Damage or destroy the residence of one or more individuals.

Permits may be required to salvage listed species from work areas to minimize risk to the species.

### 4.4 MIGRATORY BIRD CONVENTION ACT (MBCA)

The *Migratory Bird Convention Act* (MBCA) protects individuals and populations of migrating birds, including their eggs and nests. Among a number of prohibitions, this Act requires there be no disturbance to the nests or eggs of migratory birds without a permit from the Minister, and there be no addition of substances "in waters or an area

frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.”<sup>5</sup>

#### 4.5 BC WATER SUSTAINABILITY ACT

Works in and about a stream, in this case the extension of culverts, will not require a Section 11 Notification to BC Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO) as there is no provincial jurisdiction in federal lands such as the Pacific Rim Park Reserve. However Best Management Practices outlined in the *Users' Guide to Working in and Around Water*<sup>6</sup> should be implemented as Parks Canada aims to meet and/or exceed the provincial and federal requirements for habitat protection.

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## 5 APPLICATION OF THE ENVIRONMENTAL MANAGEMENT PLAN

This EMP describes the mitigation requirements of the proposed Project. It applies to all Project areas, including the road and trail right-of-ways, parking areas, access roads, trail infrastructure, toilets and temporary construction staging areas. The EMP also includes the roles and responsibilities of the parties, the environmental specifications and requirements, and has the following attached appendices:

**Appendix A: Spill Response Plan:** A Spill Response Plan has been provided in Appendix A. The Contractor is to follow this Spill Response Plan, and should any spill occur during the Project, the Contractor must report it to the Departmental Representative and OEM immediately. The OEM will complete the spill report form.

**Appendix B: Environmental Incident Report Form:** The Owner's Environmental Monitor (OEM) will fill out this Incident Report Form should any environmental incident occur during construction, and the form will be provided to Parks Canada Agency and Public Works and Government Services Canada within 24 hours of any incident. While the OEM will fill out the Incident Report Form, the Contractor will need to provide information to the OEM about the details of the incident.

**Appendix C: Species At Risk Identification Tool:** The Contractor is to review and become familiar with species at risk they may encounter on site.

**Appendix D: Invasive Plant Species Identification Tool:** The Contractor is to review and become familiar with invasive plant species they may encounter on site.

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## 6 ENVIRONMENTAL MANAGEMENT ROLES AND RESPONSIBILITIES

The following sections describe the roles and responsibilities of each of the various agencies and organizations involved with the proposed project during construction.

### 6.1 CONTRACTORS

The Contractor is responsible for all activities related to the works and to ensure that, in consultation with the Departmental Representative, applicable permits, licences or related authorizations are in place for activities that will or could affect the environment. The Contractor will take all reasonable and necessary measures to ensure that any activities undertaken in the performance of the work are conducted in such a way as to minimize any impacts to the environment in accordance with the key environmental concerns outlined in Section 2 and 3. If any

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<sup>5</sup> *Migratory Bird Convention Act*. Accessed July 13, 2010 from <[http://laws.justice.gc.ca/eng/M-7.01/page-3.html#anchorbo-ga:s\\_4](http://laws.justice.gc.ca/eng/M-7.01/page-3.html#anchorbo-ga:s_4)>.

<sup>6</sup> BC Ministry of Environment. May, 2008.

unanticipated impacts to the environment occur that do not have applicable regulatory approval, the Contractor will mitigate and restore the impacted areas as deemed appropriate by Parks Canada, the Departmental Representative and applicable regulatory agencies. A copy of the EMP and all related permits, licences and approvals, will be available on site at all times.

Throughout the execution of the work, the Contractor is solely responsible for ensuring:

1. Compliance with the Contract documents and/or related work instructions;
2. Compliance with all applicable regulatory requirements, including federal and provincial laws and any applicable local bylaws or related requirements;
3. Implementation of the environmental measures outlined in this EMP;
4. Supplying all of the materials needed to properly implement the mitigation measures outlined in this EMP (i.e. silt fencing, coco-matting, trash pumps, spill kits, sand bags, poly sheeting, etc.);
5. Review and signing off a Project Environmental Orientation Record which will be provided by the Owner's Environmental Monitor (OEM) prior to construction;
6. Submission of other information as outlined in the EMP; and
7. Coordination and discussion of the work plan with the OEM on site to ensure that all mitigation measures are installed and working properly, and compliance with the OEM should there be any shut down days during heavy rainfall events.

Due to the significant environmental requirements of this project, **the environmental monitoring component will be provided directly by Public Works and Government Services Canada (PWGSC) (the Owner) in the form of an Owner's Environmental Monitor (OEM)**. The OEM will be onsite at all times during construction near environmentally sensitive areas, and will have the authority to direct the Contractor with regards to installing mitigation measures and ensuring that appropriate measures are followed. The OEM will also have the authority to shut down construction during heavy rainfall events that preclude effective environmental mitigation.

The Contractor will therefore **not be required to hire a separate Environmental Monitor for this project, however, they will still be responsible for purchasing and effectively installing all of the mitigation measures described in this EMP**. The Contractor will be compensated for mitigation measures installed based on Section 01 35 43 - Environmental Procedures in the Contract Documents.

## **6.2 PARKS CANADA AGENCY**

Parks Canada Agency is committed to ensuring that Project activities be undertaken in such a manner that the Project will not result in significant adverse environmental effects. PCA is responsible for ensuring all mitigation measures applicable to the Project are added to the terms and conditions of any permits or contracts issued for the project. This EMP is included in the Contract Tender documents as it forms a significant part of the Contractor's obligations under the Tender. PCA may require or conduct surveillance of the Project throughout its implementation to confirm work is being carried out in accordance with the Project authorizations and permits.

Specifically, PCA will:

1. Review and sign off on the EMP, including updates made as the Project progresses;
2. Lead communication with regulatory agencies, local governments, First Nations and public stakeholders;
3. Oversee the activities of the Departmental Representative and OEM; and
4. Conduct all post-construction follow-up monitoring activities.

### 6.3 PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) DEPARTMENTAL REPRESENTATIVE

Public Works and Government Services Canada (PWGSC) are the Project Owner. PWGSC will hire the Owner's Environmental Monitor (see role below), and the Departmental Representative will work directly for PWGSC. The role of the Departmental Representative is to oversee the successful completion of the contract and manage communication between the various parties. The Departmental Representative will be onsite during construction. Further, the Departmental Representative is responsible for:

1. Tracking and updating contractual requirements and specifications;
2. Communicating the Project schedule to the project team;
3. Recording and communicating non-conformances with the EMP and other contract obligations;
4. Liaising with the various agencies and Contractors working on the Project to facilitate clear communication; and
5. Facilitating communication between the OEM and provide direction to other contract personnel.

### 6.4 OWNER'S ENVIRONMENTAL MONITOR (OEM) – CURRENT ENVIRONMENTAL LTD.

Current Environmental Ltd. will act as the OEM for the Project. **The OEM will be on site at most times during construction** to oversee the work and ensure the Contractor's compliance to the EMP and all applicable regulatory requirements. The OEM has the authority to order the Contractor to modify and/or halt any work activity if deemed necessary for the protection of the environment and observance of statutory requirements. During construction, appropriate meetings involving the crew and the OEM will be held as required to ensure ensure that environmental risks are addressed and mitigated in a proactive manner. Instances of non-conformance and environmental incidents and near misses will be brought to the attention of the Departmental Representative.

Specifically, the OEM is responsible for:

1. Updating the EMP as necessary;
2. Reviewing the EMP with the Contractor and recording the review on the Project Environmental Orientation Record (OEM will supply this form during the review process);
3. Completing weekly monitoring reports and incident reports as needed to be distributed to all Project proponents;
4. Identifying the requirement for specialty services (i.e., nesting bird surveys, amphibian salvage, fish salvage, invertebrate salvage, wildlife tree assessments, etc.);
5. Determining the scope of the required fish and amphibian salvage work and completing this salvage work ahead of the construction\*;
6. Directing the Contractor and the Contractor's site supervisors on the implementation of various mitigation measures required throughout construction and ensuring the proper implementation of these mitigation measures;
7. Completing water quality monitoring (measuring turbidity levels) throughout construction;
8. Halting work if a major non-conformance occurs or an unforeseen environmental sensitivity is discovered.

**\*Due to the specific skill set required for certain mitigation measures described in this document, the OEM will complete the necessary fish and amphibian salvage and isolation work required for this Project. However, the Contractor will still need to coordinate their schedule and timing with the OEM to assist with these activities.**

**Other than fish salvage and amphibian salvage, the installation and implementation of all other mitigation measures are the responsibility of the Contractor.**

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## **7 ENVIRONMENTAL COMMUNICATIONS**

Environmental communication involves a number of documents and activities, including the following:

1. **Environmental Management Plan:** The EMP details the roles, responsibilities and expectations regarding the activities associated with the works.
2. **Project Environmental Orientation Record:** The PEOR is used to document the review of the EMP with the Contractor(s). The PEOR will be prepared by the OEM and brought to the initial kick-off meeting.
3. **Environmental Monitoring Reports:** The OEM will be responsible for completing and submitting environmental monitoring reports to PWGSC and Project Proponents.
4. **Environmental Incident Reporting:** The procedures for incident reporting are outlined in the EMP and are the responsibility of the OEM to complete for submission to PWGSC and Project Proponents.

More details for each type of environmental communication are provided below.

### **7.1 PROJECT ENVIRONMENTAL ORIENTATION RECORD (PEOR)**

Prior to mobilization, the Contractor must sign a PEOR which will be provided by the OEM.

1. The OEM is responsible for ensuring that the environmental risks and protection requirements related to the work are reviewed with the Contractor and that a record of the discussion is documented in the PEOR.
2. Additional PEORs will be required by the Departmental Representative and the OEM if there is a significant change in scope to the EMP and/or the works being performed by the Contractor.
3. The Contractor is responsible for understanding the requirements of the EMP and communicating these requirements to all personnel, including subcontractors.
4. The OEM and the Contractor will sign the PEOR, acknowledging an understanding of the environmental requirements of the Contract and the associated protection measures.

The PEOR outlines the key environmental issues anticipated to be associated with the works. The OEM is to review the PEOR with the Contractor's Representative, typically at the kick-off meeting, and all parties are to sign the PEOR as a record of this orientation. The Contractor and the Departmental Representative will ensure that:

1. The contact list appended to the PEOR is kept up to date; and
2. A copy of the PEOR is to be kept available on site at all times.

### **7.2 ENVIRONMENTAL MONITORING REPORTS**

The OEM will be onsite at all times during construction, and sometimes even when work is not occurring on site to ensure that mitigation measures are working effectively. The OEM will provide weekly environmental monitoring reports to the Departmental Representative, PWGSC and Project Proponents. At a minimum, environmental monitoring reports will include:

1. Dates, times and personnel conducting site visit;
2. Local weather for the week, including temperature and precipitation;
3. Current site activities and Contractors present;



4. Identification of activities that are taking place on site at the time of the site visit and the status of their compliance with respect to the EMP;
5. Photographs of the site and construction activities;
6. Water quality measurements and laboratory data, if applicable;
7. Identification of any instances of environmental non-compliance with this EMP, or environmental incidents/near misses; and
8. Recommended mitigation measures for observed instances of environmental noncompliances or environmental incidents/near misses.

### **7.3 ENVIRONMENTAL INCIDENT RESPONSE/REPORTING**

An environmental incident is one that has caused an impact to the environment. An environmental near miss is an incident that had the potential to cause an impact to the environment. These incidents and near misses include but are not limited to:

1. Adverse impact on the quality of air, land or water, on wildlife, on aquatic species or on species at risk;
2. Unauthorized release or discharge to the environment;
3. Exceedance of compliance requirement limit(s) as documented in a regulatory instrument (i.e., permit, order, licence, authorization, agreements etc.);
4. Violation of legislation, related policies or regulations;
5. External reporting requirement derived from a commitment, especially if attached to a nonroutine or unexpected event;
6. Adverse publicity with respect to the environment;
7. Alteration of, or damage to, heritage or archaeological resources; and
8. Legal or regulatory action with respect to any of the above.

The Contractor must ensure the following:

1. All crew members and subcontractors are able to identify environmental incidents and near misses and know how to respond to them.
2. All environmental incidents and near misses are to be reported to the Departmental Representative and OEM as soon as feasible but not more than 24 hours after the event.
3. Where required to report an incident about confirmed or potential violations of laws, regulations, or local bylaws, the Contractor will immediately notify the Departmental Representative and OEM before reporting to the appropriate agencies.
4. The OEM will fill out the Incident Report Form (Appendix B) and submit to the Departmental Representative, PWGSC, and Project Proponents within 24 hours of the incident.

The Departmental Representative and OEM will liaise with external agencies, if applicable.



## 8 MITIGATION REQUIREMENTS

The following table (Table 4) outlines the environmental management specifications and requirements, and mitigation measures that the Contractor will need to apply to all aspects of the Project during construction.

Table 4. Environmental management specifications and requirements, and mitigation measures for the proposed works in Pacific Rim National Park.

8.1 GENERAL MEASURES
<ol style="list-style-type: none"> <li>1) All Contractors must address and implement the provisions outlined in this EMP.</li> <li>2) All activities must comply with applicable laws and regulations, including local bylaws and related orders.</li> <li>3) All permit and approval conditions, terms and requirements must be implemented.</li> <li>4) All Contractors must review and sign the PEOR prior to starting work. The PEOR form will be provided by the OEM at the pre-construction meeting, and a signed final version must be on site at all times which will include an up-to-date list of contact information.</li> <li>5) Environmental issues must be a component of the regular tailgate meetings.</li> <li>6) The Contractor must follow the Spill Response Plan provided in Appendix B and must report any spill to the OEM and Departmental Representative so that the appropriate Spill Response Form can be filled out and distributed by the OEM.</li> <li>7) The Contractor must communicate the work schedule regularly with the OEM and Departmental Representative so that pre-work activities (such as avian nest surveys, amphibian salvage, fish salvage, and other mitigation measures) can be completed in a timely manner.</li> </ol>
8.2 VEGETATION MANAGEMENT, DISTURBANCE OR REMOVAL
<ol style="list-style-type: none"> <li>1) The OEM and all Project crew need to be trained in identifying the key invasive plant species identified in Appendix D . As well, all occurrences of rare or listed "plant species at risk" must be immediately reported to the OEM and Departmental Representative.</li> <li>2) Prevent the spread of invasive plant species that could be found on site by cleaning equipment before moving into new areas. Remove all weeds and suspect plants from equipment and vehicles to prevent spread of invasive species.</li> <li>3) Separate cleared material containing invasive species from other cleared material and perform disposal at an appropriate transfer facility (i.e., landfill).</li> <li>4) Cover loads during transport to help prevent spores or seeds from falling out of the vehicle.</li> <li>5) While equipment is on site, remove invasive plants that occur near work areas and trails.</li> <li>6) Only use clean road material from invasive plant-free borrow pits and quarries. <b><u>Conduct an inspection of any fill material source to identify any potential invasive species issues.</u></b></li> <li>7) Locate vehicle wash areas (if applicable) at least 30 m from the High Water Mark of any waterbody. Treat used wash water to prevent seed dispersal and release of contaminants.</li> <li>8) Restore bare soil as quickly as possible after disturbance.</li> <li>9) If wetland areas are disturbed, allow them to re-vegetate naturally as long as weed infestation is not a</li> </ol>

concern.

- 10) Re-vegetate areas no longer needed for construction with preferred species (i.e., shrub and herb cuttings or plugs or potted plants). **Please note that Pacific Rim National Park Reserve does not permit seed mixes to be used within the park, even if the mix is considered a native seed mix.** In most cases, exposed areas will be covered with Erosion Control Blankets (ECB) and left to re-vegetate naturally. This plan may be adapted as needed throughout construction.
- 11) If working within an area of weed infestation, clothing, tools and equipment must be thoroughly cleaned before leaving the site.

### 8.3 WILDLIFE HABITAT ALTERATION, DISTURBANCE, OR LOSS

- 1) All work must be completed in such a manner as to protect all species at risk and wildlife from harm.
- 2) All Project crew must be trained to recognize any species at risk that may occur at the site (Appendix C ). All sightings of rare or listed species at risk (wildlife or plants) must be immediately reported to the OEM and Departmental Representative.
- 3) Any wildlife deaths or other wildlife issues arising during construction must be immediately reported to the OEM and Departmental Representative.
- 4) Do not destroy, remove or clear any active bird nests. Cease work at site and contact the OEM and Departmental Representative if bird nests (active or inactive) are encountered within or near the work area.
- 5) Should any vegetation (including grasses) trimming or removal be required between **March 12 and August 17, a bird nest assessment must be undertaken no earlier than five days prior to the required clearing.** A nest search protocol will have to be developed and coordinated with the OEM in advance. For this contract, all clearing should be completed outside of the bird nesting window, however the above procedures will be followed if any additional clearing is necessary within the nesting window.
- 6) Implement Best Management Practices for Raptor Conservation during Urban and Rural Land Development in BC (BC Ministry of Environment, 2013).
- 7) All onsite staff will be familiar with and observe the "Living with Wildlife", "You are in bear country", "You are in wolf and cougar country" recommendations published by Parks Canada and available on the Parks Canada website.
- 8) All wildlife attractants will be secured on the work-site. No food, food waste, cook stoves, garbage, drink containers (full or empty), recyclable materials will be left neither unattended nor accessible to wildlife.
- 9) Fish and amphibians will need to be salvaged from work areas prior to the commencement of activities that may harm them. Due to the specialized requirements for this project, **fish salvage and amphibian salvage will be completed by the OEM and a separate team of specialists prior to work occurring at each location.** However, the Contractor will need to coordinate their schedule with the OEM to accommodate this salvage work prior to construction.
- 10) The fish salvage component of the Project has the potential to be quite involved depending on the timing of work, and a separate section (Section 8.4 below) has been dedicated to the requirements for fish salvage.
- 11) General measures for amphibian salvage are as follows:
  - a. Amphibian salvage will be coordinated and undertaken by the OEM and a separate team of qualified and trained individuals immediately ahead of construction occurring.

- b. The amphibian salvage strategy will be to conduct passive salvage techniques within the project footprint prior to construction occurring (i.e. simplify the habitat), and then conducting a final sweep to actively remove amphibians from the worksite on the day that construction is scheduled in each area.
- c. Work may not begin until the OEM salvage team has deemed the immediate work area clear of adult amphibians and amphibian eggs.
- d. Salvage licenses may be required and will be factored into the amphibian salvage plan.
- e. Note the following Northern Red-legged Frog life cycle events: breeding congregation (approximately January to April), juvenile dispersal from their natal ponds (rainy nights from late July to early October with peaks typically happening in August and early September) and migration to breeding ponds (late September to December).

#### 8.4 FISH ISOLATION AND SALVAGE

- 1) It is anticipated that all culvert work will need to be preceded with fish isolation measures if there is flowing water at the time of construction. While the roadside ditches and small watercourses involved in the Project do not support fish during the summer months, all of these areas have the potential to support fish (especially rearing Coho salmon) during the winter months (October to May) when the water levels are higher.
- 2) **For this contract, the OEM will implement all fish salvage operations including setting up stop nets and actively removing fish from the work area ahead of the construction crew for any culvert work occurring on site.** Fish isolation measures may also need to be applied for other project activities if there is any risk of encroaching into any of the ditches or watercourses surrounding the project site.
- 3) The following specifications will be followed by the OEM for fish isolation/salvage:
  - a. 5 mm stop nets shall be set up within flowing ditches and watercourses on either end of the work area to prevent fish from entering the work areas during construction.
  - b. Stop nets need to be able to withstand heavy rainfall events as this is likely to occur during construction.
  - c. Once nets are set up and properly sealed along the edges and bottom, fish salvage efforts shall begin. Salvage efforts shall be performed in order of least aggressive to more aggressive starting with minnow trapping, then pole-seining, then a last pass with an electrofisher if needed. All fish caught during the salvage effort will be recorded, and then placed in suitable habitat downstream or upstream of the stop nets based on an evaluation by the OEM.
  - d. The OEM and anyone assisting with fish salvage will be required to have a fish salvage license.
  - e. The fish isolation effort should begin a minimum of three days prior to instream work occurring, and the Contractor must inform the OEM of the schedule no less than 5 days prior to work occurring so that fish salvage can be properly coordinated. The Contractor will need to account for the potential of delays or lost days of work to accommodate fish salvage.
- 4) In addition to fish isolation measures, flow isolation will be required with all of the culvert work and any additional Project activities that have the potential to encroach into any of the ditches or watercourses surrounding the Project site. **Flow isolation, involving setting up coffer dams and pumping clean water around the worksite, will be the responsibility of the Contractor and will be monitored by the OEM.** While these flow diversion activities will need to be coordinated with the fish isolation activities, there will be a clear divide where the OEM will perform the fish salvage and the Contractor will perform the flow isolation once the fish salvage is complete. Flow isolation shall be set up by the Contractor:

- a. Using poly sheeting and poly sand bags to build coffer dams upstream and downstream of the work areas;
  - b. Using gas or electric trash pumps to divert clean flowing water around the worksite and into downstream areas (it is anticipated that 3" size gas pumps at minimum will required at most of the culvert locations to perform this task); and
  - c. Ensuring that fish isolation as described above is established prior to setting up any flow isolation.
- 5) **It is required that a minimum of two 3" gas pumps in good working condition with at least 200ft of discharge hose each will be available on site at all times during construction in order to set up flow isolation measures as needed.** These pumps should be outfitted with intake screens (1/4" maximum) such as the one shown below in order to prevent the fish mortality and pump malfunction during construction. Other equipment that needs to be provided by the Contractor and available at all times includes poly sand bags (enough to set up at least 2 coffer dams at each culvert location) and rolls of poly sheeting to seal off the coffer dams. A more comprehensive materials list is provided in Section 9 below.



Example of an appropriate suction hose strainer for the 3" gas pumps required on site

## 8.5 SEDIMENT AND EROSION CONTROL

- 1) Erosion control measures that prevent sediment from entering any waterway, water body or wetland in the vicinity of the construction site are a critical element of the project and shall be implemented by the Contractor.
- 2) Sediment and sediment laden waters should not be released off the Project site and outside of Pacific Rim National Park.
- 3) Construction activities will be managed to ensure compliance with Sections 32, 35 and 36 of the *Fisheries Act*. Contractors should also reference the *Standards and Best Practices for Instream Works* (BC Ministry of Water, Land and Air Protection, 2004) where applicable. Water quality monitoring will be performed by the OEM and will focus on monitoring sediment generation and release to adjacent and/or downstream watercourses as well as to amphibian breeding areas.
- 4) Water samples will be tested onsite for turbidity with handheld meters. Water quality monitoring will be done as determined by the OEM on the basis of visual monitoring of water clarity, with measurements taken if deemed necessary, as well as following precipitation events in excess of 25 mm. Water quality monitoring sites should be established at stream crossings and detention feature outlets.
- 5) As a guideline, the BC Water Quality Guidelines (BC Ministry of Environment, 2001) for protection of aquatic life stipulates an acceptable increase of 8 NTU when background levels are between 8 and 80 NTU, and a 10% increase when background levels exceed 80 NTU. In the event the established limit is exceeded, the Contractor will need to stop work and/or set up additional sediment and erosion control measures until the turbidity levels decrease.

- 6) The implementation and maintenance of sediment control measures and related equipment and supplies are the responsibility of the Contractor, and will be designed, constructed, and maintained as required by the OEM. **Construction activities will not commence until proper sediment control measures are in place.** Regular inspection of sediment control measures during construction will ensure these are functioning and maintained as required.
- 7) In all flowing watercourses and ditches, water diversion and flow isolation will need to be established by the Contractor to ensure that clean water continues to be supplied to downstream areas (See Section 8.4 for details). Do not pump water containing suspended materials into waterways – including ditches, sewer or any drainage systems.
- 8) Silt laden waters that may enter a watercourse can be pumped to well vegetated areas for filtration. Discharge hoses are to be placed so as not to cause erosion. This is usually accomplished by laying poly sheeting and using large rocks or wood to dissipate discharge flows. **Note that the soils surrounding the project site are very saturated, and do not have much capacity for filtering sediment laden water, therefore this option should only be used as a last resort. It is much more preferential to isolate the work areas from any flowing water where applicable and divert the clean water around the worksite so that no silt laden water is generated.**
- 9) Filter fabric dams, rock check dams, settling ponds, geotextiles, French drains, interception ditches, and silt fencing should be used as needed on a site-specific basis to control erosion. Filtration should be accomplished using filter fabric keyed into substrates and banks, and elevated using stakes. Silt fencing is not an acceptable mitigation technique to control erosion in flowing ditches; however it is useful for containing slumping areas and for use as baffles to slow water velocities.
- 10) Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting a watercourse. This will be done at the discretion of the OEM. Erosion and sediment control measures should be inspected within 24 hours after intense rainfall events.
- 11) Runoff and stormwater are to be managed and directed away from areas of exposed soils.
- 12) Do not dump excavated fill, waste material or debris in waterways.
- 13) Watercourses are not to be traversed by machinery at any time without the consent of the OEM.
- 14) Wherever possible, soil stockpiles will be placed a minimum of 30 m from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage.
- 15) Soil stockpiles with the potential to erode into watercourses are to be covered with poly sheeting. Other techniques, such as terracing or surface roughening can greatly reduce surface erosion on steeper slopes.
- 16) **Permanent exposed soil areas and erosion-prone slopes that may potentially erode into watercourses are to be covered with thick coco-matting erosion control blankets (not straw matting which releases debris downstream) or crushed rock. As outlined in the design drawings, at minimum the Contractor will need install coco-matting as per manufacturers specifications on all of the banks of the newly exposed ditches along the south side of Wick Road.**
- 17) Clearing should take place immediately prior to excavation and earthworks to minimize the length of time that soils are exposed. Vegetation in adjoining areas shall not be disturbed.

## 8.6 CULVERT INSTALLATION

- 1) All culverts shall be installed following *Standards and Best Practices for Instream Works* (BC Ministry of Water, Land and Air Protection, 2004) to avoid sedimentation and damage to the riparian area of the watercourse.

- 2) The culverts shall be installed so as to ensure fish passage criteria are met.
- 3) In-stream works shall be completed within the **DFO least risk timing window which is June 15th to September 15th** for Vancouver Island.
- 4) Construction should be carried out expediently to minimize the time spent working in aquatic habitats.

## 8.7 CLEARING AND GRUBBING

- 1) Prior to the commencement of work, all areas to be cleared will be walked by the OEM and Contractor to identify any environmental resources that need to be protected (e.g. setback areas and wildlife trees).
- 2) The Contractor will need to clearly mark the grubbing and stripping limits in the field prior to the commencement of work.
- 3) Vegetation identified for protection, (e.g., mature trees and potential wildlife trees) will be left intact and root systems undisturbed.
- 4) The installation of appropriate surface drainage controls should be in place prior to clearing activities.
- 5) Only those areas designated on site plans will be cleared. Trees will be flagged in advance of clearing to demarcate the limits of the work. Marked trees will not be felled. Clearing activities will not remove any vegetation outside the authorized clearing limits.
- 6) Grubbing will be suspended during and immediately after intense rainstorms that have resulted in excessive run-off.
- 7) The grubbing and stripping of unstable or erodible soil will be limited to that which is absolutely necessary to satisfy the requirements of the project. Where construction can be completed without grubbing and stripping, none shall occur.
- 8) Large woody debris (logs, stumps and roots) currently existing on the forest floor should be set aside and replaced upon completion of remediation works to maintain amphibian habitat.
- 9) All stockpiles of grubbed material within the specified clearing limits will be located so as not to obstruct the access or work of others or natural drainage patterns.

## 8.8 FUELS AND HAZARDOUS MATERIALS

- 1) The accidental release of petroleum, oils, hydraulic fluids, lubricants, concrete additives, anti-freeze or other hazardous materials onto land surfaces or into waterbodies may result in degradation of habitat quality and could be a threat to human health. As such, it must be actively prevented and the Contractor must provide a Spill Response Plan (which can be adapted from the one provided in Appendix A of this EMP) prior to the commencement of construction.
- 2) The Spill Response Plan must be reviewed by the Contractor and all of the work crews as part of the tailgate meetings prior to the commencement of work, and it must be re-reinforced regularly as the crew moves on to different components of the project.
- 3) A large spill kit will be on hand at all times during construction.
- 4) Smaller spill kits are to be maintained on all machinery.
- 5) Spill response supplies must be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order.

- 6) All identified spills will be cleaned up immediately, and contaminated soils and vegetation will be removed for appropriate disposal. Notify the OEM if any hydrocarbon sheen or odour is detected during excavations.
- 7) Workplace Hazardous Materials Information System (WHMIS) sheets must be kept on site for all hazardous materials used. All hazardous material containers must be labeled.
- 8) Refuelling of equipment and maintenance of equipment with the potential for accidental spills (i.e. oil changes, lubrications) is to occur only at designated fuelling stations and located at least 30 m from all watercourses. Tarps should be laid down prior commencement of work to facilitate clean up.
- 9) All fuel, chemicals, and hazardous materials will be clearly marked and stored a minimum of 30 m from any waterbody.
- 10) If accidental mixing of fuels, chemicals, and hazardous materials does occur, the waste product will be removed to an approved disposal/recycling facility.
- 11) Aboveground storage tanks will be constructed on stable foundations, designed to minimize uneven settling and corrosion. The framework of the storage tank will be such that the allowable stress of the tank itself will not be exceeded. The storage area will contain spills and leaks.
- 12) The storage area will be covered to prevent accumulation of rainwater.
- 13) There is to be no smoking in the vicinity of fuel storage areas.
- 14) Fuel tanks within the containment area will be located off the ground.
- 15) All hazardous materials containers must be designed for that purpose and must be less than 5 years old, leak free, and have a property fitted cap.
- 16) Pumps and jerry cans are to be placed on poly sheeting and sorbent pads or drip trays to contain spills. Vehicles and equipment left on site overnight should have drip trays underneath.
- 17) Used oil, filters, and grease cartridge lubrication containers, and other products of equipment maintenance will be collected and kept in a secure receptacle for later disposal.
- 18) In the event of a spill, follow the Spill Response in Appendix A The following general guidelines should be followed:
  - a. Spills of all sizes must be immediately reported to the OEM and Departmental Representative. Spills to the receiving environment are to be reported to the BC Provincial Emergency Program (1-800-663-3456) if they exceed the reportable limits (e.g. 100 litres of fuel or oil). The OEM will complete the necessary Spill Report Form.
  - b. Stop work in the vicinity of the spill;
  - c. The Contractor and OEM will be responsible for coordinating clean-up and collecting all pertinent information.
  - d. Deploy on-site personnel to build containment dykes, or pump spilled contaminant into storage drums.
  - e. Apply sorbent pads and booms as necessary.
  - f. Dispose of all contaminated debris, cleaning materials, and absorbent material by placing in an approved disposal site.
  - g. Debrief all site personnel on the incident and take additional precautions to ensure that similar accidents will not recur.



## 8.9 GARBAGE AND WASTE

- 1) The Contractor and workers shall dispose of hazardous wastes in conformance with the *Environmental Contaminants Act* and applicable provincial regulations while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.
- 2) Work areas will be kept in a safe, clean, and sanitary condition. All waste, rubbish and debris will be kept in centralized locations within the project areas and removed from the park and project sites upon completion of each work phase.
- 3) Waste containers will be wildlife and wind proof containers to prevent dispersal.
- 4) Food wastes will be stored in leak-proof storage containers or vehicles that will prevent access by wildlife.
- 5) Food and waste that may attract wildlife from the site will be removed daily.
- 6) All wastes originating from construction, trade, hazardous and domestic sources shall not be mixed, but will be kept separate and disposed of in accordance with applicable regulation(s).
- 7) Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in Pacific Rim National Park. These wastes shall be contained and removed in a timely and approved manner by the Contractor and workers, and disposed of at an appropriate waste landfill site located outside the Park.
- 8) A concerted effort shall be made by the Contractor and workers to reduce reuse and recycle materials where possible.
- 9) Sanitary facilities, such as a portable container toilet, shall be provided by the Contractor and maintained in a clean condition. Facilities should be secured so as not to fall over and located at least 30 m from any waterbody.

## 8.10 AIR AND NOISE EMISSIONS

- 1) Optimize truck loading to reduce trips.
- 2) Minimize idling.
- 3) Implement speed limits.
- 4) Use clean, well-maintained machinery.
- 5) Cover loads that may emit dust.
- 6) Ensure all equipment has property functioning noise control.
- 7) Avoid unnecessary revving and engine brakes.

## 8.11 FIRE PREVENTION AND CONTROL

- 1) Construction equipment shall be operated in a manner and with all original manufacturers' safety devices to prevent ignition of flammable materials in the area.
- 2) Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented.
- 3) Fires or burning of waste materials is not permitted.
- 4) In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is



safe to do so. Parks Canada staff shall be notified of any fire immediately.

- 5) Provide supervision, attendance and fire protection measures as directed.
- 6) Obtain all required permits from the province and federal agencies.

### **8.12 DISTURBANCE TO HERITAGE RESOURCES/ARCHAEOLOGICAL SITES**

- 1) All Contractors are responsible for protecting archaeological resources identified during the course of work. Because it is not always possible to identify all archaeological resources within an area, Contractors should be made aware of the potential presence of undiscovered archaeological resources that are protected under the Heritage Conservation Act.
- 2) In the event of a chance archaeological find, suspend work and immediately notify the Departmental Representative and OEM for instructions on how to continue. Evidence of past human occupation can include such things as human bones, pit houses, stone tools, rock paintings, shell deposits (middens) or culturally modified trees.
- 3) If suspected human remains are found, the Contractor shall:
  - a. Stop work immediately and notify the Departmental Representative, who will notify the Police;
  - b. Do not disturb the site;
  - c. Stake or flag off the affected location to prevent additional disturbance;
  - d. Treat the remains with full dignity and respect;
  - e. Do not allow any employee or bystander to touch or photograph the remains;
  - f. Cover any exposed bones with plastic sheeting, blankets or other clean coverings until the Police arrive;
  - g. Assign an employee to watch over the remains until the Police arrive; and
  - h. Do not backfill the area.

### **8.13 SITE RESTORATION**

- 1) All areas of soil disruption and trail rutting or compaction must be promptly repaired and reclaimed.
- 2) Minimize activities that cause soil compaction and rutting (e.g., minimize vehicle traffic and use of equipment on exposed soils, use existing roadways or disturbed areas to travel within site, use equipment of low bearing weight or low pressure tires or tracked vehicles within sensitive areas etc.).
- 3) Compacted soils must be rehabilitated similar to the productive capacity of the area.
- 4) Remove sediment control measures when no longer required, as directed by the OEM.
- 5) Upon completion of construction activities, remove surplus materials and wastes from the work sites and dispose of at appropriate facilities.

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## 9 REQUIRED EQUIPMENT AND SUPPLIES

The following is a required “minimum” supply list for environmental mitigation. The Contractor’s environmental budget must incorporate all of the items listed below, and have contingency funds for additional supplies requested by the Contractor’s EM throughout the duration of the Project.

- 1) Centrally located large spill kits of appropriate capacity (i.e., capacity to handle 110% of the largest possible spill) are to be onsite at all times.
- 2) Smaller spill kits on all equipment.
- 3) Floating sorbent booms of sufficient length to span the largest watercourse.
- 4) Trash pumps (at least two 3” gas pumps required) with minimum 200 ft of discharge hose each.
- 5) Drip trays sized to fit jerry cans, generators, and any vehicles/equipment left onsite overnight.
- 6) Plastic poly sheeting (6mm) for coffer dams, to prevent scouring at end of pump discharge hoses and for covering exposed soils as needed.
- 7) Sand bags for building coffer dams and for re-directing runoff water as needed.
- 8) Coco-matting Erosion Control Blankets (not straw-matting which releases debris downstream) for all of the exposed banks of watercourses and ditches, as outlined in the Contract Documents.
- 9) Wooden stakes - 2 to 3 ft in length (50).
- 10) Rolls of silt fencing (mainly for de-lineating work areas and/or for keeping amphibians isolated from the work areas as needed) (Minimum 300 m).
- 11) Flagging tape or snow fencing (for delineating clearing limits).
- 12) 3-6” crushed rock and pea gravel for installing check dams as needed for sediment and erosion control.

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## 10 CLOSURE/CONCLUSIONS

With this project occurring within a National Park with numerous sensitive habitats and Valued Ecosystem Components located within the project footprint, environmental protection will be of utmost importance during the implementation of this project. The majority of works proposed for the Project pose medium to low risk to Valued Ecosystem Components if the mitigation measures prescribed herein are implemented in a diligent manner. As much detail as possible has been provided in this EMP to inform all project personnel of the environmental requirements of the project, however all project personnel will need to be prepared to be flexible, communicative, and cooperative in order to ensure the success of this project and the effective protection of Valued Ecosystem Components associated with this project.

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## 11 DISCLAIMER

This report was prepared exclusively for Parsons Ltd. by Current Environmental Ltd. The quality of information, conclusions and estimates contained herein is consistent with the level of effort expended and is based on: i) information available at the time of preparation; ii) data collected by the authors and/or supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Parsons Ltd. only, subject to the terms and conditions of its contract or understanding with Current Environmental Ltd. Other use or reliance on this report by any third party is at that party’s sole risk.

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## 12 REFERENCES

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**APPENDIX A SPILL RESPONSE PLAN**

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(4 pages)

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**Follow these procedures if a spill of fuels, chemicals, or other hazardous materials occurs**

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**Contacts**

Report major spills (>100 L) of Class 3 Flammable liquids to the Provincial Emergency Program (PEP) 1-800-663-3456

**9-1-1 FOR EMERGENCY SERVICES**

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**Response**

For spills of any volume follow these steps:

- 1) ENSURE HUMAN SAFETY
- 2) STOP THE FLOW (when possible)
- 3) SECURE THE AREA
- 4) CONTAIN THE SPILL
- 5) NOTIFY
- 6) CLEAN-UP
- 7) REPORT
- 8) DE-BRIEF

**1) ENSURE HUMAN SAFETY**

- Assess the situation, never rush in.
- Warn other people in the immediate vicinity.
- Determine what product has been spilled.
- If the spilled product is flammable ensure there are no ignition sources nearby.
- Wear appropriate personal protective equipment.

**2) STOP THE FLOW**

- Act quickly.
- Stop the flow or spill at its source.
- Close valves, shut off pumps, or plug holes/leaks.

**3) SECURE THE AREA**

- Inform the Environmental Monitor and Construction Supervisor of the spill.
- Limit worker access to spill area.
- Prevent public entry to the site.

Continued next page...

**4) CONTAIN THE SPILL**

- Prevent spillage from entering drainages (watercourses, ditches, culverts, drains).
- Use ample spill sorbent material to contain the spill.
- As necessary, use a dyke, pumping into containment structures, or other method to prevent discharge from the site.
- Make every effort to minimize contamination.

**5) NOTIFY**

- When necessary (spills of flammable materials >100L) the first external call should be made to: Provincial Emergency Program (PEP) 1-800-663-3456 (24 Hour)
- Provide necessary spill details to other external agencies.
- See Spill Reporting Notification Chart and Table of Reportable Levels of Certain Substances provided below.

**6) CLEAN-UP**

- The Environmental Monitor will be responsible to ensure that clean-up methods comply with Ministry of Environment requirements including the *Environmental Management Act* and Regulations, or relevant regulation.
- All material and equipment used in clean-up (e.g. used spill containment material, and sorbent pads) are to be disposed of appropriately.
- Soils or other materials contaminated by the spill will be treated as special wastes and be disposed of as required on a site-specific basis. Residue sampling may be required in association with soil contamination to ensure complete removal and/or treatment.

**7) REPORT**

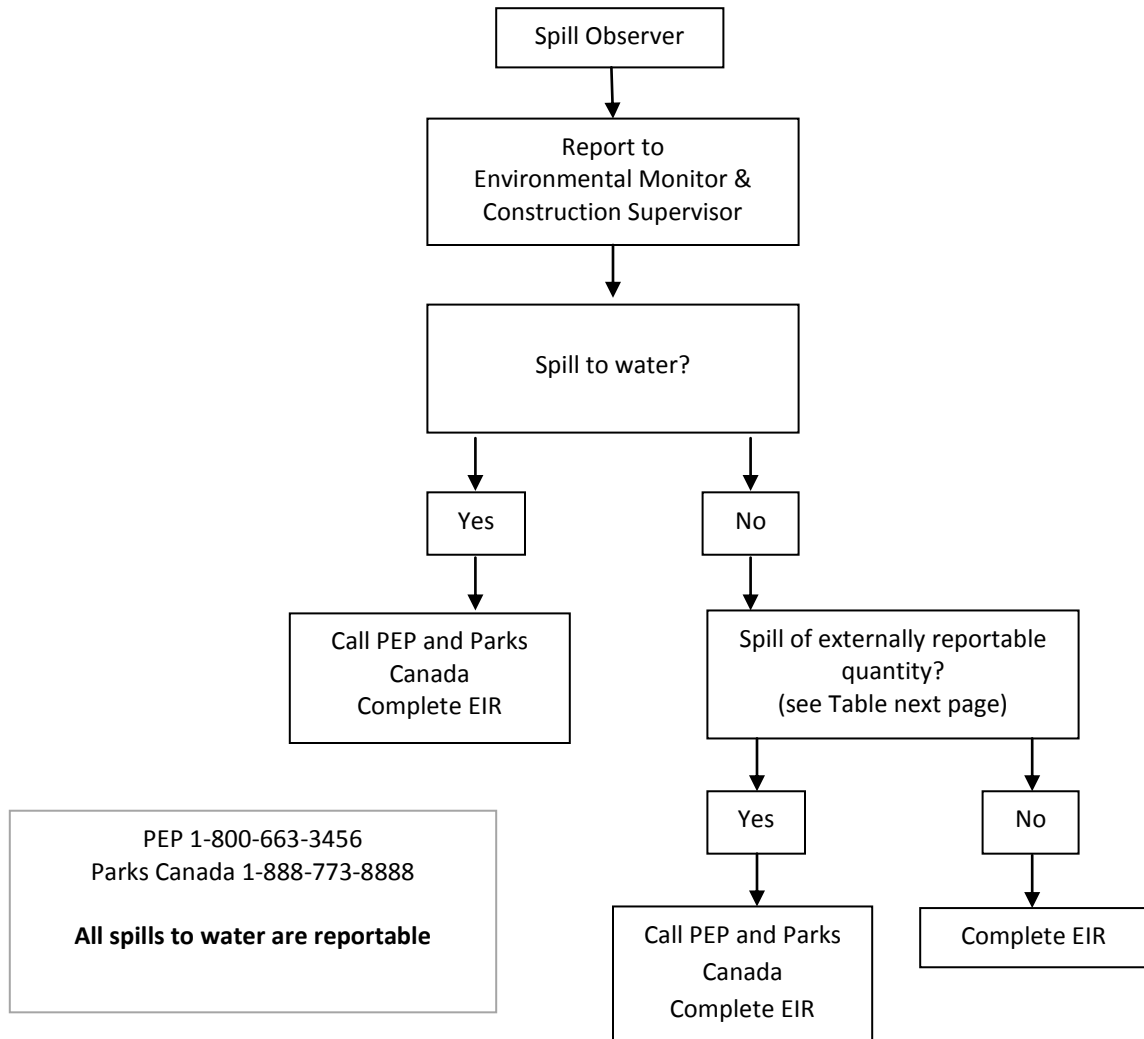
- Complete an Environmental Incident Report (EIR).
- The EIR will be submitted to MoT/MoE/DFO as required (or any other pertinent regulatory agencies), and copies will be retained by the EM and Construction Supervisor.

**8) DE-BRIEF**

- Following the clean-up of a spill the Construction Supervisor will call a meeting with all personnel to discuss the following as a means to inform future prevention and spill management techniques:
  - Identify the source of the spill and whether it could have been avoided.
  - Review the sequence of events used to handle the spill, including what was done right/wrong.
  - Determine whether the equipment used to handle the spill was available when needed and in sufficient quantity.
  - Discuss how the spill response procedure could be improved.

**Continued next page...**

**Spill Reporting Notification Chart**



Continued next page...

**Table of Reportable Levels of Certain Substances**

(Adapted from *Environmental Management Act – Spill Reporting Regulation*)

Item	Column 1 Substance spilled	Column 2 Specified amount
1	Explosives of Class 1 as defined in section 3.9 of the Federal Regulations	any
2	Flammable gases, other than natural gas, of Division 1 of Class 2 as defined in section 3.11 (a) of the Federal Regulations	10 kg, if the spill results from equipment failure, error or deliberate action or inaction
3	Non-flammable gases of Division 2 of Class 2 as defined in section 3.11 (d) of the Federal Regulations	10 kg, where spill results from equipment failure, error or deliberate action or inaction
4	Poisonous gases of Division 3 of Class 2 as defined in section 3.11 (b) of the Federal Regulations	5 kg, where spill results from equipment failure, error or deliberate action or inaction
5	Corrosive gases of Division 4 of Class 2 as defined in section 3.11 (c) of the Federal Regulations	5 kg, where spill results from equipment failure, error or deliberate action or inaction
6	Flammable liquids of Class 3 as defined in section 3.12 of the Federal Regulations	100 L
7	Flammable solids of Class 4 as defined in section 3.15 of the Federal Regulations	25 kg
8	Products or substances that are oxidizing substances of Division 1 of Class 5 as defined in section 3.17 (a) and 3.18 (a) of the Federal Regulations	50 kg
9	Products or substances that are organic compounds that contain the bivalent "-O-O-" structure of Division 2 of Class 5 as defined in sections 3.17 (b) and 3.18 (b) of the Federal Regulations	1 kg
10	Products or substances that are poisons of Division 1 of Class 6 as defined in section 3.19 (a) to (e) and 3.20 (a) of the Federal Regulations	5 kg
11	Organisms that are infectious or that are reasonably believed to be infectious and the toxins of these organisms as defined in sections 3.19 (f) and 3.20 (b) of the Federal Regulations	any
12	Radioactive materials of Class 7 as defined by section 3.24 of the Federal Regulations	All discharges or a radiation level exceeding 10 mSv/h at the package surface and 200 µSv/h at 1 m from the package surface
13	Products or substances of Class 8 as defined by section 3.25 of the Federal Regulations	5 kg
14	Miscellaneous products or substances of Division 1 of Class 9 as defined by section 3.27 (1) and (2) (a) of the Federal Regulations	50 kg
15	Miscellaneous products or substances of Division 2 of Class 9 as defined in section 3.27 (1) and (2) (b) of the Federal Regulations	1 kg
16	Miscellaneous products or substances of Division 3 of Class 9 as defined in section 3.27 (1) and (2) (c) of the Federal Regulations	5 kg
17	Waste asbestos as defined in section 1 of the Hazardous Waste Regulation	50 kg
18	Waste oil as defined in section 1 of the Hazardous Waste Regulation	100 l
19	Waste containing a pest control product as defined in section 1 of the Hazardous Waste Regulation	5 kg
20	A substance not covered by items 1 to 19 that can cause pollution	200 kg
21	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas

\*Refer to *Transportation of Dangerous Goods Regulation under the Transportation of Dangerous Goods Act* for substance definitions.

\*\* If there is any doubt regarding the substance spilled, specified amount, or whether it is reportable, take a cautious approach and report it.

**END – Spill Response Plan**





**ADDITIONAL INFORMATION**

(additional notes, sketches, photos, etc.)

**SIGN OFF**

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**Contractor representative signature**




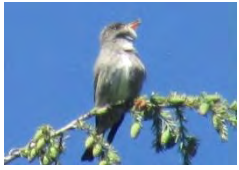

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**Date**






*January 25th, 2017*

**APPENDIX C SPECIES AT RISK IDENTIFICATION**

Table 5. Species at risk identification tool for species likely to be encountered during the project works. Source: BC Species and Ecosystems Explorer unless otherwise noted.

Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Northern Red-legged Frog	<i>Rana aurora</i>	Special Concern	Blue	 <p>©GAS. Photo: Marguerite Gregory</p>
Description <ul style="list-style-type: none"> <li>• Back is dark brown, grey, olive, or reddish, with many small, irregular, indistinct black spots and flecks</li> <li>• Prominent, lighter folds along the sides of the upper body</li> <li>• Dark mask on the side of the face, above a cream stripe on the upper lip</li> <li>• Throat and chest are white with black or grey flecks</li> <li>• Lower belly and underside of the legs are bright red (more extensive on older adults and may not be obvious on juveniles)</li> </ul>				
Western Toad	<i>Anaxyrus boreas</i>	Special Concern	Blue	 <p>Photo: Jeanne Ross</p>
Description <ul style="list-style-type: none"> <li>• Yellowish, dusky, tan, grey, or greenish back with dark markings (spotted to mottled)</li> <li>• Often with light stripe down back</li> <li>• Dry and bumpy skin</li> <li>• Oval glands behind eyes</li> <li>• Up to 110-125 mm long</li> <li>• Tadpoles are small and black</li> </ul>				
Wandering Salamander	<i>Aneides vagrans</i>	Special Concern	Blue	 <p>Photo: Kristiina Ovaska</p>
Description <ul style="list-style-type: none"> <li>• Small (to 180 mm total length)</li> <li>• Dark brown to black with gold blotches and flecks</li> <li>• Squared toes</li> <li>• Tail cross section is circular<sup>7</sup></li> </ul>				
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Threatened	Blue	 <p>Photo: Kathryn Clouston</p>
Description <ul style="list-style-type: none"> <li>• Large (18-20 cm) flycatcher with large head</li> <li>• Proportionately short tail</li> <li>• Plumage brownish-olive dorsal (brownier on juveniles) with a dull white to yellowish throat, breast, and belly</li> <li>• Darker streaked or mottled chest patches</li> </ul>				
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	Special Concern	Blue	 <p>Photo: Jeanne Ross</p>
Description <ul style="list-style-type: none"> <li>• Dark grey with purple-grey head</li> <li>• White crescent with a patch of iridescent green-bronze on the back of neck</li> <li>• In flight tail is dark with a lighter grey band at tip</li> <li>• Feet and bill are yellow<sup>8</sup></li> </ul>				

<sup>7</sup> <http://linnet.geog.ubc.ca/efauna/Atlas/Atlas.aspx?sciname=Aneides%20vagrans>







Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Common Nighthawk	<i>Chordeiles minor</i>	Threatened	Yellow	 Photo: SARA/COSEWIC
Description <ul style="list-style-type: none"> <li>• Long, narrow, pointed wings</li> <li>• Tail slightly notched</li> <li>• Dark brown with black, white, and buff specks</li> <li>• In flight, wide white stripe seen on underside of wings<sup>9</sup></li> </ul>				
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	Threatened	Blue	 Photo: Mike Yip
Description <ul style="list-style-type: none"> <li>• Chunky seabird</li> <li>• Black bill</li> <li>• Dark tail</li> <li>• Breeding: dark brown dorsal and mottled ventral</li> <li>• Winter: white ventral, white shoulder streak on dark dorsal</li> </ul>				
Northern Goshawk, <i>laingi</i> subspecies	<i>Accipiter gentilis laingi</i>	Threatened	Red	 Photo: SARA/COSEWIC
Description <ul style="list-style-type: none"> <li>• Large hawk (50-60 cm)</li> <li>• Long, rounded tail</li> <li>• Rounded wings</li> <li>• Dorsal/upper: dark blue-slate to black on head</li> <li>• Ventral: pale grey and finely barred</li> <li>• Broad white stripe over eye</li> </ul>				
Northern Pygmy-owl, <i>swarthi</i> subspecies	<i>Glaucidium gnoma swarthi</i>	n/a	Blue	 Adult (front) Photo: Jason Forbes
Description <ul style="list-style-type: none"> <li>• Small forest owl</li> <li>• Long-tailed<sup>10</sup></li> </ul>				
Western Screech-owl, <i>kennicottii</i> subspecies	<i>Megascops kennicottii kennicottii</i>	Threatened	Blue	 Photo: Stephen R. Cannings
Description <ul style="list-style-type: none"> <li>• Small owl</li> <li>• Distinct ear tufts</li> <li>• Yellow eyes<sup>11</sup></li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo

<sup>8</sup> [http://www.registrelep-sararegistry.gc.ca/species/speciesDetails\\_e.cfm?sid=1013](http://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=1013)

<sup>9</sup> [http://www.registrelep-sararegistry.gc.ca/species/speciesDetails\\_e.cfm?sid=986](http://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=986)

<sup>10</sup> <http://www.env.gov.bc.ca/wld/documents/statusrpts/b113.pdf>







<sup>11</sup> [http://www.sararegistry.gc.ca/virtual\\_sara/files/cosewic/sr\\_western\\_screech-owl\\_1012\\_e.pdf](http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_western_screech-owl_1012_e.pdf)

Cutthroat trout, <i>clarkii</i> subspecies	<i>Oncorhynchus clarkii clarkii</i>	n/a	Blue	 <p>Photos: Pamela Zevit</p>
Description Adult <ul style="list-style-type: none"> <li>Red or orange streak under jaw</li> <li>Head and side of body spotted</li> <li>Belly and fins often spotted</li> <li>Sea-run silvery in colour</li> <li>Freshwater darker with coppery sheen<sup>12</sup></li> </ul> Fry/Parr <sup>13</sup> <ul style="list-style-type: none"> <li>Red/yellow mark on throat</li> <li>Up to 5 parr marks on dorsal ridge anterior of dorsal fin</li> <li>Spotted dorsal fin</li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
American water shrew, <i>brooksi</i> subspecies	<i>Sorex palustris brooksi</i>	n/a	Red	 <p>Photo: Bob Peterson</p>
Description <ul style="list-style-type: none"> <li>Large (up to 15.2 cm)</li> <li>Dry fur: glossy grey to black dorsal, silver-grey to light brown ventral</li> <li>Tail also bi-coloured<sup>14</sup></li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Ermine, <i>anguinae</i> subspecies	<i>Mustela erminea anguinae</i>	n/a	Blue	 <p>Photo: Ryan Merrill</p>
Description <ul style="list-style-type: none"> <li>Dark brown weasel</li> <li>Lighter ventral</li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Keen's myotis	<i>Myotis keenii</i>	n/a	Blue	 <p>Photo: Henderson State University</p>
Description <ul style="list-style-type: none"> <li>Dorsal glossy brown</li> <li>Indistinct dark shoulder spots</li> <li>Ventral buffy grey</li> <li>Black ears</li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Little brown myotis	<i>Myotis lucifugus</i>	Endangered	Yellow	 <p>Photo: Paul Pratt</p>
Description <ul style="list-style-type: none"> <li>Dorsal cinnamon-buff to dark brown</li> <li>Ventral buffy to pale grey</li> <li>Dorsal hairs have long, glossy tips</li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	n/a	Blue	 <p>Photo: Dave Bunnell</p>
Description <ul style="list-style-type: none"> <li>Very large ears joined across forehead</li> <li>Dorsal hairs slate or grey with cinnamon brown to blackish brown tips</li> <li>Ventral hairs slate</li> </ul>				
Common name	Scientific name	COSEWIC Status	Provincial Status	Photo

<sup>12</sup> <http://www.env.gov.bc.ca/wld/documents/fishfacts/cutthroattrout.pdf>

<sup>13</sup> [https://www.adfg.alaska.gov/static/home/library/pdfs/habitat/adfg\\_hr\\_id\\_cards\\_v1.1.pdf](https://www.adfg.alaska.gov/static/home/library/pdfs/habitat/adfg_hr_id_cards_v1.1.pdf)


<sup>14</sup> [http://ibis.geog.ubc.ca/biodiversity/factsheets/pdf/Sorex\\_palustris\\_brooksi.pdf](http://ibis.geog.ubc.ca/biodiversity/factsheets/pdf/Sorex_palustris_brooksi.pdf)

Dromedary jumping-slug	<i>Hemphillia dromedarius</i>	Threatened	Red	 <p>Photo: Kristiina Ovaska</p>
Description <ul style="list-style-type: none"> <li>• Large slug (up to 60 mm)</li> <li>• Dorsal hump with part of yellowish internal shell visible through a slit</li> <li>• Overall dorsal colour grey to tan and brown</li> <li>• Ventral pale yellow, orange, or grey</li> </ul>				
<b>Common name</b>	<b>Scientific name</b>	<b>COSEWIC Status</b>	<b>Provincial Status</b>	<b>Photo</b>
Warty jumping-slug	<i>Hemphillia glandulosa</i>	Special Concern	Red	 <p>Photo: Kristiina Ovaska</p>
Description <ul style="list-style-type: none"> <li>• Small, robust (up to 30 mm)</li> <li>• Grey to tan</li> <li>• Dorsal hump with part of yellowish internal shell visible through a slit</li> <li>• Mantle with conical papillae (bumps)</li> </ul>				
<b>Common name</b>	<b>Scientific name</b>	<b>COSEWIC Status</b>	<b>Provincial Status</b>	<b>Photo</b>
Edwards' beach moth	<i>Anarta edwardsii</i>	Endangered	Red	 <p>Photo: Jeremy Gatten</p>
Description <ul style="list-style-type: none"> <li>• Stocky, medium-sized moth</li> <li>• Wingspan 32-38 mm</li> <li>• Head, thorax, abdomen and antennae uniform brown-grey</li> <li>• Forewing has terminal line made up of a series of black dots</li> <li>• Hindwing has dark grey or dull black terminal band</li> </ul>				
<b>Common name</b>	<b>Scientific name</b>	<b>COSEWIC Status</b>	<b>Provincial Status</b>	<b>Photo</b>
Sand-verbena moth	<i>Copablepharon fuscum</i>	Endangered	Red	 <p>Photo: SARA/COSEWIC</p>
Description <ul style="list-style-type: none"> <li>• Medium-sized moth</li> <li>• Nocturnal</li> <li>• Dark to golden brown</li> <li>• Wingspan 35-40 mm</li> <li>• Forewings with black and light yellow lines<sup>15</sup></li> </ul>				
<b>Common name</b>	<b>Scientific name</b>	<b>COSEWIC Status</b>	<b>Provincial Status</b>	<b>Photo</b>
Seaside centipede lichen	<i>Heterodermia sitchensis</i>	Endangered	Red	 <p>Photo: Alva Roberts</p>
Description <ul style="list-style-type: none"> <li>• Leafy lichen<sup>16</sup></li> <li>• Whitish grey to pale greenish grey</li> <li>• Found on lower branches of mature Sitka spruce</li> </ul>				
<b>Common name</b>	<b>Scientific name</b>	<b>COSEWIC Status</b>	<b>Provincial Status</b>	<b>Photo</b>
California wax-myrtle	<i>Myrica californica</i>		Blue	 <p>Photo: Gary Lewis</p>
Description <ul style="list-style-type: none"> <li>• Shrub or small tree (2-6 m tall)</li> <li>• Leaves alternate, evergreen, toothed, sharp-pointed</li> <li>• Flowers in spikes</li> <li>• Fruits are 4-8 mm long round, warty, and waxy nutlets</li> </ul>				

<sup>15</sup> [http://www.sararegistry.gc.ca/species/speciesDetails\\_e.cfm?sid=789](http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=789)






<sup>16</sup> [http://www.registrelep-sararegistry.gc.ca/species/speciesDetails\\_e.cfm?sid=124](http://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=124)






Common name	Scientific name	COSEWIC Status	Provincial Status	Photo
Oregon ash	<i>Fraxinus latifolia</i>	n/a	Red	 <p>Photo: Jamie Fenneman</p>
<p>Description</p> <ul style="list-style-type: none"> <li>• Deciduous tree up to 25 m tall</li> <li>• Rough, grey-brown bark with deep cracks at maturity</li> <li>• Young twigs are hairy-woolly</li> <li>• Leaves are opposite, compound with 5-7 leaflets, egg shaped, 12-30 cm long, toothed</li> <li>• Small, inconspicuous flowers</li> <li>• Fruits are winged and in clusters</li> </ul>				

**APPENDIX D INVASIVE PLANT SPECIES IDENTIFICATION TOOL**

Table 6. Invasive plant species identification tool for species likely to be encountered during the project works. Source: Invasive Species Council of BC (photos), Klinkenberg (2013; descriptions)<sup>17</sup>.

Common Name	Description	Photo
Canada thistle	<ul style="list-style-type: none"> <li>• Perennial herb</li> <li>• Alternate, lance-shaped leaves with spines</li> <li>• Leaves green on top and white and hairy on the underside</li> <li>• Numerous, small flowerheads</li> <li>• Flowers pink to purple</li> <li>• Produces seeds</li> </ul>	
English ivy	<ul style="list-style-type: none"> <li>• Evergreen climbing shrub</li> <li>• Alternate leaves 4-10 cm long</li> <li>• Leaves leathery, gloss and broadly egg-shaped to triangular with 3-5 lobes</li> <li>• Terminal flowers are greenish-yellow</li> <li>• Bluish-black berries</li> </ul>	
Himalayan blackberry	<ul style="list-style-type: none"> <li>• Thicket-forming shrub</li> <li>• Stems 5-angled with hooked prickles</li> <li>• Alternate, egg-shaped leaves with double saw-toothed edges and pointed tips</li> <li>• Leaves green and smooth on top, and greyish-wooly on underside with prickles on midveins</li> <li>• 5 leaflets or 3 leaflets on flowering stems</li> <li>• 5-20 white to pink terminal flowers which produce black berries</li> </ul>	
Orange hawkweed	<ul style="list-style-type: none"> <li>• Perennial herb</li> <li>• 10-60 cm tall</li> <li>• Erect, long bristly-hair stems</li> <li>• Stems leak milky juice when broken</li> <li>• Basal leaves 4-20 cm long and bristly-hairy</li> <li>• Stem leaves small or absent</li> <li>• Several orange-red terminal flowers</li> <li>• Produces dark, ribbed seeds</li> </ul>	
Oxeye daisy	<ul style="list-style-type: none"> <li>• Perennial herb 20-80 cm tall</li> <li>• Sage-like odour</li> <li>• Basal leaves alternate, lobed or toothed, egg- to spoon-shaped, stalked, and 4-15 cm long</li> <li>• Stem leaves small, not stalked, not toothed or lobed</li> <li>• Terminal flowers with white petals and yellow centre</li> <li>• Black, ribbed seeds</li> </ul>	

<sup>17</sup> Klinkenberg, B. (Editor) (2013). E-Flora BC: Electronic Atlas of the Flora of British Columbia. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver. Accessed from < <http://ibis.geog.ubc.ca/biodiversity/eflora/>>

<p>St. John's-wort</p>	<ul style="list-style-type: none"> <li>• Perennial herb</li> <li>• Branched, erect stems</li> <li>• Stem leaves are 1-3 cm long, lance-shaped, and have glandular and black marginal dots</li> <li>• 100+ terminal yellow flowers</li> <li>• Produces dark brownish seeds</li> </ul>	
<p>Scotch broom</p>	<ul style="list-style-type: none"> <li>• Tall shrub, up to 3 m</li> <li>• Green, erect, branched 5-angled stems</li> <li>• Stalked lower leaves with 3 leaflets</li> <li>• Upper branches with simple egg-shaped to oblong leaflets</li> <li>• Yellow, pea-like flowers solitary or in pairs</li> <li>• Produces black, flattened pods with 5-12 seeds</li> </ul>	
<p>Tansy ragwort</p>	<ul style="list-style-type: none"> <li>• Biennial/short-lived perennial herb</li> <li>• Solitary or branched erect stem</li> <li>• Stem sparsely to densely white woolly-hairy</li> <li>• Stalked basal leaves long (4-20 cm) and deeply lobed</li> <li>• Stem leaves similar but smaller and not stalked</li> <li>• Terminal clusters of yellow flowers</li> <li>• Produces seeds</li> </ul>	
<p>Yellow iris</p>	<ul style="list-style-type: none"> <li>• Perennial herb</li> <li>• Mostly basal narrow, long (50-90 cm) leaves with pointed tips</li> <li>• 2-12 pale to deep yellow flowers on each stem</li> <li>• Produces numerous seeds</li> </ul>	