Public Works and Government Services Canada

Requisition No. EZ899-172520/A

SPECIFICATIONS
For:

Visitor Centre Parking Lot Repaving
Fort Langley National Historic Site
Fort Langley, BC

Project No.
R.078891.001

APPROVED BY:

Program Manager, PWGSC — Date Dec 17 2016.

Construction Safety Coordinator — Date Dec. 19

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. G. CRAMMERS — DEC 19, 2016

TENDER:

Project Manager — Date 16/12/21

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END OF SECTION

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 Agency (PCA).

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 Master Municipal Contract Documents Platinum Edition (2009)

.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.

.4 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.4 Codes, Bylaws, Standards, Best Management Practices .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, Master Municipal Construction Documents MMCD, 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.

.6 Comply with "Parks Canada National Best Management Practices Roadway, Highway, Parkway and Related Infrastructure" contained in *Appendix H* of these specifications.

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 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.

1.8 Project Location

.1 The project is located at the Fort Langley National Historic Site, Fort Langley British Columbia (#23433 Mavis Avenue.)

1.9 Time of Completion

.1 Substantial completion of the work shall be done within 12 weeks after Contract Award. However, irrespective of the General Condition Clause of Substantial Performance, if paving goes beyond 12 weeks due to weather related delays, an appropriate time extension may be provided.

1.10 Contract Method

.1 Construct Work under Lump Sum Price Contract.

1.11 Section Includes

.1 In general, Work under this Contract covers the:

.1 Removal of existing asphalt, excavation;

.2 Supply & installation of sanitary sewer mains, leads, and manholes;

.3 Supply & installation of storm sewer mains, leads, manholes, and catch basins and removal of existing catch basins and piping;

.4 Supply & installation of water mains, services, chamber, valves, and irrigation system including 8 hours standby time;

.5 Reshaping and grading of the subgrade;

.6 Gravel sub-base and base supply and installation;

.7 Replacement of damaged sections of concrete curb and sidewalk;

.8 Asphalt paving;

.9 Pavement markings, including remarking existing markings on the main entry road;

.10 Reinstallation of two signs;

.11 Reinstallation of traffic loop detectors and electrical duct and cabling at parking lot exit;

.12 Installation of RPVC electrical conduits and junction boxes as shown on Sheet 3 of 3;

.13 Remove and replace wood rail fence;

.14 Minor landscape restoration.

1.12 Work Included .1 Work includes, but is not limited to: (quantities are approximate)

.1 Managing of construction to accommodate local traffic. Construction of both the general parking lots and the bus parking area need to be done in two phases so that parking facilities are continuously provided to the Fort.

.2 Removal, and disposal of asphalt pavement (5,530 square metres).

.3 Clearing and grubbing of landscape areas (70 square metres).

.4 Removing, salvaging, and reinstallation two signs and metal posts.

.5 Removing, salvaging, and reinstallation wood rail fencing (22 m).

.6 Removing, salvaging, and reinstallation two metal pipe gates.

.7 Excavation and disposal of existing base, sub-base, and native materials

(1,450 cubic metres).

.8 Excavation and salvage, depositing and compacting of existing base materials (100 cubic metres).

.9 Shaping and re-compacting of remaining material to produce uniform sub-grade (5,700 square metres.)

.10 Saw cutting asphalt at match lines (70 metres.)

.11 Remove and replace concrete curb (94 metres.)

.12 Remove and replace concrete curb and gutter (64 metres.)

.13 Remove and replace concrete sidewalks (24 square metres.)

.14 Concrete access ramps (12 square metres.)

.15 Asphalt paths and patching (40 square metres.)

.16 Supply, placing, shaping, and compacting of 75 mm crushed rock sub-base (840 cubic metres).

.17 Supply, placing, shaping, and compacting of 19 mm crushed granular base (560 cubic metres).

.18 Supply and apply prime coat to the prepared base (5,600 square metres.)

.19 Supply and placement of hot mix asphalt (1,020 tonnes.)

.20 Supply and install thermoplastic pavement markings (100mm lines - 600 metres; 200 mm lines – 120 metres, 300 mm lines – 45 metres, arrows – 21 count, wheel chair & blue background – 6 count.)

.21 Reinstall ducting, traffic loop, and cables at exit gate (one.)

.22 Install two runs of 2 X 50 mm RPVC ducts (60 m), 4 type 10 junction boxes, associated asphalt, concrete, landscape removal and restoration.

.23 Protect or replace existing 50 mm street light conduit and copper conductors under parking areas during excavation (45 metres conduit, 100 metres of 3 – 4 copper wire conductors.)

.24 Supply and install storm drainage system including: (a) 150 mm diameter PVC SDR28 lead (115 m); (b) 200 mm diameter PVC SDR28 lead (25 m); (c) 250 mm diameter PVC SDR35 storm main (250 m); (d) 300 mm diameter PVC SDR35 storm main (45 m); (e) 450 mm diameter PVC SDR35 storm main (7.5 m); (f) 600mm diameter catch basins (17 count);

(g) 1050mm diameter manholes, complete including overbuild of existing 200 mm storm main (7 count, 16.5 m of 1050 mm risers); (h) 1200mm diameter manhole, complete (1 count, 3.5 m of 1200 mm risers); (i) Water Quality manhole, complete as per details on Sheet C6 (1 count); (j) removal and reinstallation of curb and walks to permit installation, and (k) removal and disposal of existing drainage system to permit installation of new work.

.25 Supply and install sanitary sewer system including: (a) 150 mm diameter PVC SDR35 sanitary main (29 m); (b) 200 mm diameter PVC SDR35 sanitary main (165 m); (c) 1050mm diameter manholes, complete (4 count, 8.0 m of 1050 mm risers); (d) Sanitary inspection chamber (1 count); (e) 200 mm diameter temporary caps (2 count); and (f) removal and reinstallation of curb and walks to permit installation.

.26 Supply and install water and irrigation system including: (a) 100 mm diameter PVC SDR18 water main (155 m); (b) 50 mm diameter HDPE DR11 irrigation line (215 m); (c) Underground hose connection c/w chamber (6 count); (d) double check valve assembly c/w chamber (1 count); (e) 50 mm gate valve (1 count); (f) 100mm diameter temporary cap (2 count); 9g) 100 mm PVC SDR 18 drain from check valve chamber (8 m); and (h) removal and reinstal curb and walks to permit installation.

.27 The contractor shall include in the lump sum price bid a total of eight hours of standby time for the crew(s) and equipment installing the underground utilities to permit the Archeologist to investigate and recover archeological, heritage, or other types of materials encountered during the work. This time may be spread over several encounters over the period of the work. Standby time above a total of eight hours will be paid by the Owner to the Contractor at force account rates.

.28 Topsoil placement for landscape (10 cubic metres), grass sod (50 square metres), and back mulch (50 square metres, 75 mm thick.)

.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.

1.14 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 Commencement and completion of Work of each section of the specifications or drawings as outlined.

.2 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.

1.15 Cost Breakdown .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail (as listed in clause 1.12 of this section) as directed by the Departmental Representative and aggregating Contract price.

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 Change orders.
.6 Other modifications to Contract.
.7 Field test reports.
.8 Manufacturers' installation and application instructions.
.9 One set of record drawings and specifications for "as-built" purposes.
.10 Project Safety Plan / Traffic Control Plan.
.11 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 Provide inspection authorities with plans and information required for issue of acceptance certificates.

.3 Furnish inspection certificates in evidence that the work conforms to the requirements of the authority having jurisdiction.

1.18 Contractor's Use of Site

.1 Use of site:

.1 Parking lot, exclusive and complete for each phase for execution of Work. River Road, as per permit obtained from Township of Langley.

.2 Assume responsibilities 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 Perform Work in accordance with Contract documents. Ensure work is carried out in accordance with indicated phasing.

.3 Do not unreasonably encumber site with material or equipment

1.19 Traffic Control

.1 Do not close any areas of road or parking lot without consulting Departmental Representative. Contractor to provide vehicle access to open areas of the parking lot with minimal use of detours. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in "Traffic Control Manual for Work on Roadways". The Contractor is advised that the Fort will remain open to the public during construction and accommodation of vehicle and pedestrian traffic is a requirement of the contract. Refer to section 01 35 00, Special Procedures for Traffic Control, for detailed requirements.

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 Cutting and

.1 Cut existing surfaces only as required to accommodate new work and as directed

Patching by the Departmental Representative.

.2 Remove items so shown or specified.

.3 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final construction.

.4 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.

1.23 Setting Out Work .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated. Road profile may be modified by the Contractor with Departmental Representative's approval to reduce removal of existing material from site.

.2 Provide devices needed to lay out and construct work.

.3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

1.24 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.

1.25 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 works of various trades and distribute to affected parties.

.3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.

.4 Submit copy of coordination drawings and meeting notes to Departmental

Representative for information purposes.

.5 Coordinate and plan for all necessary road/lane closures ahead of time.

.3 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 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.

.4 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

.5 Maintain efficient and continuous supervision.

1.26 Relics, Antiques, Archeological, and Heritage Objects and Areas

.1 The entire Fort Langley National Historic Site, including the Visitor Centre Parking Lot, is considered to be an archaeological site, with significant pre-contact and historical components.

.2 Contractor must work with the Owners archaeologist and abide by the terms and conditions of the Research and Collections Permit issued by the Parks Canada Archaeology and History Branch to the Owners archaeologist.

.3 The Owners archaeologist will conduct an archaeological impact assessment for this Project prior to construction. If significant archaeological resources are identified, this may result in changes to Project design and/or scheduling.

..4 An archaeological impact assessment will be conducted under a provincial Heritage Conservation Act permit of the proposed upgrades to the Storm Sewer at River Road delaying construction at this location until September 2017.

.5 During construction, an archaeological monitor must be on site and present for any developments with the potential to impact sub-surface soils and sediments, disturbed or intact, located beneath any introduced fill in the Visitor Centre Parking Lot. This includes archaeological monitoring of the installation of the electrical ducts and storm sewer, landscaping, and tree removal as described Division 26- electrical, Division 31-earthwork, Division 32- roadway, and Division 33-Utilities, as well as for the proposed water, storm sewer, and sanitary system improvements within the Visitor Centre Parking Lot.

.6 Archaeological monitoring will be completed by the Owners archaeologist with the assistance of First Nations with Aboriginal interests in the Project area.

.7 The Owners archaeologist will be present to record and collect any observed cultural resources, including structures, sites, or things that may be valued for their historical, archaeological, architectural and/or paleontological significance.

.8 Artifacts and items of historical and scientific interest shall remain the property of Parks Canada.

.9 The Owners archaeologist will be on call for archaeological chance find call-outs in the event structures, sites, or things of historical, archaeological, architectural and/or paleontological significance are identified during construction activities in areas determined to be of low archaeological potential.

.10 The contractor is required to provide immediate notice to the Departmental Representative if evidence of cultural resources are encountered during excavation/construction, and await Departmental Representative's written instructions before proceeding with work in this area.

.11 The Contractor shall plan the excavations such that the areas of previously undisturbed ground (new asphalt areas and areas where excavation is greater than 150 mm below the existing surface such as the bus parking bays) shall be excavated in a coordinated method to minimize the requirements for an archaeologist. The Contractor shall include in their costs the ability to shift their work within the Project area to permit the archaeologist to assess observed archaeological deposits. The Contractor shall include in the lump sum price bid a total of 8 hours of standby time for the crew(s) installing the underground utilities. If the lost production time exceeds this amount of time Owner shall compensate the Contractor for their actual costs resulting from these examinations.

.12 The Archeological Overview Assessment Dated July 26, 2016 for the Fort Langley NHS Parking Improvements is in *Appendix G* of these specifications.

1.27 Project Meetings

.1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.28 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:

.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.

1.29 As-Built Documents

.1 The Departmental Representative will supply the Contractor with 2 sets of drawings, 2 sets of specifications, and 1 copy of the original AutoCAD files for "as-built" purposes.

.2 As work progresses, Contractor is to maintain accurate records to show all deviations from the Contract documents. Notations shall me made to create as-built specifications, drawings, and shop drawings as changes occur. At the end of the work Contractor is to supply the Departmental Representative the records of the changes in the drawings and specifications to prepare as-built drawings.

1.30 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.

1.31 Environmental Protection

.1 Prevent extraneous materials from contaminating air, land, or water beyond construction area.

.2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.

.3 Ensure proper disposal procedures in accordance with all applicable regulations.

1.32 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.

1.33 Additional Information

.1 The following Geotechnical memos are included in the contract Document:

Appendix A to Appendix E: Geotechnical Memorandum
Reference No. VAN-00228940-A0 Pavement Upgrades – National Historic Site, Fort Langley B.C.

Appendix F: Shallow Soils Assessment Memorandum
Reference No. V10-10314 Soils analysis for contaminants, National Historic Site, Fort Langley B.C

.2 The information contained in these reports, by their 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.

.3 The following Archeological Assessment is included in the contract Document:

Appendix G: Archeological Overview Assessment
Fort Langley National Historic Site Parking Improvements, dated July 26, 2016.

.4 The following Best Management Practices is included in the contract Document:

Appendix H: Archeological Overview Assessment
Parks Canada National Best Management Practices, Roadway, Highway, Parkway, and Related Infrastructure, dated July 23, 2015.

1.34 System of Measurement

.1 The metric system of measurement (SI) is used on this Contract.

1.35 Familiarization with Site

.1 Before submitting tender, it is recommended to visit the site to become familiar with all conditions likely to affect the tender cost.

1.36 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

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 Other business
- .14 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.

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 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
.7 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 - Closeout Procedures.
.8 Monthly progress claims, administrative procedures, photographs, and holdbacks.
.9 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 - Quality Control.
.10 Insurances and transcript of policies.
.11 Other business.

.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 requests for payment for review, and for transmittal to Departmental Representative.

.3 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.

.4 Process substitutions through Departmental Representative.

.5 Process change orders through Departmental Representative.

.6 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.

.4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

END OF SECTION

PART 1 - GENERAL

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 in color with dates and descriptions on CD disk with weekly progress reports. Relate dates and descriptions to photo file names in a separate text file on disk.
.2 Number of photographs: minimum of 100 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

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

PART 1 - GENERAL

1.1 Section Includes	.1	Informational and Warning Devices.
	.2	Protection and Control of Public Traffic.
	.3	Operational Requirements.
1.2 Measurement for Payment	.1	No separate payment will be made for any special procedure for traffic control and accommodation. Payments for dust control to be included in the Lump Sum prices in this Contract.
	.2	Provide continuous traffic flow to the general parking and bus parking lots and access to main visitors Centre entry during construction. Provide appropriate traffic and pedestrian guide signs.
1.3 References	.1	"Traffic Control Manual for Work on Roadways" (distributed by Province of B.C., Ministry of Transportation and Highways).
1.4 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	Access shall generally be provided on paved asphalt or concrete surfaces. When alternative surfaces are used keep the traveled way graded, free of pot-holes and provide and maintain reasonable access to visitors Centre in the vicinity of the Work.
1.5 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 Control Manual for Work on Roadways".
	.2	Meet with Departmental Representative prior to commencement of Work to determine signs and other devices required for project.
1.6 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 Parking for both busses / RV's and autos shall be maintained throughout the construction along with pedestrian access between the parking areas and the Visitors Centre entrance. Access for vehicles and pedestrians shall be on concrete or asphalt surfaces except for brief periods during construction where the sequence of the work does not allow for this. A well maintained gravel surface shall be provided at such times.

.3 The work shall be constructed in two (or more) phases. One general parking bay, a portion of the access, and about half of the bus parking area shall be constructed in the first phase. After the completed areas are opened to the public for use the remaining parking bays, bus parking area and the remaining portion of the access road shall be rehabilitated.

.4 Remove signs and barriers upon completion of the project.

END OF SECTION

PART 1 - GENERAL

1.1 References .1 Government of Canada:

.1 Canada Labour Code - Part II
.2 Canada Occupational Health and Safety Regulations.

.2 Province of British Columbia:

.1 Workers Compensation Act, Part 3, Occupational Health and Safety.
.2 Occupational Health and Safety Regulation.

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
.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:

.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.

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.

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.

.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.

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.

1.23 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.

1.24 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.

1.25 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.

1.26 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.
.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.

1.27 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 forwarded to the Departmental Representative.

1.28 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

PART 1 - GENERAL

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.

.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

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 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 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 re-fuelling, 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 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 major 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 major 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.

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 Whenever possible, re-seed with grass mixtures that are free of weeds, locally adapted, non-invasive, and quick to establish. Spread seed in the early spring or late fall to ensure successful establishment.

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.

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.

END OF SECTION

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. These items shall be included in all work as part of total contract amount.

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 Sub-Base	
1.1	Compaction:	1 test / 250 m^2
1.2	Sieve:	1 test / material source / 1000 m^3
2.	Granular Base	
2.1	Compaction:	1 test / 250 m^2
2.2	Sieve:	1 test / material source / 1000 m^3

3.	Full Depth Reclamation		
3.1	Compaction:	1 test / 250 m^2	
4.	Asphalt		
4.1	Marshall test:	1 test / 500 t of asphalt (min of 1 / day) ASTM D1559, D3203, C117, C136	
4.2	Cores:	1 per 100 m of lane per lift	
5.	Concrete		
5.1	Air Content and Slump:	1 test / 50 cu.m., min of 1 set / day	
5.2	Strength: minimum of 1 set/day	1 set of 3 cylinders per 50 cu.m. and	

.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 Departmental Representative (DR) it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, DR may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, with the amount determined by DR.

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-build 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

PART 1 - GENERAL

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

PART 1 - GENERAL

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.
	.4	Existing 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. 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.

END OF SECTION

PART 1 - GENERAL

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

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.

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 (and Engineer) for review prior to any installations.

1.5 Contractor's Options for Selection of Products for Tendering

.1 Products are specified by "Prescriptive" specifications: select any product meeting or exceeding specifications.

.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.

.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

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.
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

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.

.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

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 two (2) years after the date of issue of the Construction Completion Certificate by the Engineer.

.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 two (2) years 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 two (2) years 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 PWGSC or their 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

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

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.

.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

PART 1 -
GENERAL

1.1 Measurement for Payment

.1 No measurement will be made under this Section. Payments for such work to be included in the lump sum prices in this contract.

1.2 References

.1 American Concrete Institute (ACI):

.1 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.

.2 American National Standards Institute/American Concrete Institute (ANSI/ACI):

.1 ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.
.2 SP-66-04, ACI Detailing Manual 2004.

.3 American Society for Testing and Materials (ASTM):

.1 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
.2 ASTM A276 Standard Specification for Stainless Steel Bars and Shapes.
.3 ASTM A775 Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
.5 ASTM A767 Standard Specification for Zinc –Coated (Galvanized) Steel Bars for Concrete Reinforcement.
.6 ASTM A955 Standard Specification for Deformed and Plain Stainless Steel Bars.
.7 ASTM A959 Guide for specifying harmonized standard grade compositions for wrought stainless steels.
.8 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
.9 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

.4 Canadian Standards Association (CSA):

.1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
.2 CAN3-A23.3, Design of Concrete Structures for Buildings.
.3 CAN3-G30.3, Cold Drawn Steel Wire for Concrete Reinforcement.
.4 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.
.5 CSA G30.14, Deformed Steel Wire for Concrete Reinforcement.
.6 CSA G30.15, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
.7 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.
.8 CAN/CSA-G40.21, Structural Quality Steels.

.9 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
.10 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
.11 CAN/SGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
.12 CAN/CSA-S6-06, Canadian Highway Bridge Design Code (CHBDC).

.5 Reinforcing Steel Institute of Canada:

.1 RISC, Reinforcing Steel Manual of Standard Practice.

1.3 Shop Drawings .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings, lengths, and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada (RSIC).

.3 Detail lap lengths and bar development lengths to CAN/CSA-S6-06, unless otherwise indicated.

1.4 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.5 Material Storage

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.4 Do not stockpile material so as to interfere with site operation and drainage.

PART 2 - PRODUCTS

2.1 Materials .1 Reinforcing steel: grade 400, deformed bars, epoxy coated, to CAN/CSA-G30.18, unless indicated otherwise.

.2 Galvanized reinforcing: Conform to ASTM A767M, specification for Zinc-Coated (Galvanized) steel bars for concrete reinforcement. Coating to conform to Class 11 (610 g/m2). Supplementary requirement S1 shall apply.

.3 Epoxy Coated Reinforcing: Conform to ASTM A775/A775M, Standard specification for Epoxy Coated steel reinforcing bars. Coating shall be Scotchcote 213, fusion bonded epoxy coating, thickness 300+85 micrometers.

.4 Stainless steel reinforcing steel shall conform to the requirements of ASTM A276 and ASTM A955M – UNS designation UNS S31653, S31803, S30400, or S32304. After rolling, the bars shall be pickled to remove mill scale and surface oxidation. The minimum yield strength shall be 420MPa. The design of the stainless steel reinforcing steel, including hooks, development length and bar splices shall be based on yield strength of 420 MPa.

.5 Substitute different size bars only if permitted in writing by Departmental Representative.

.6 Cold-drawn annealed steel wire ties: to CSA G30.3.

.7 Tie Wire: minimum 1.6 mm annealed type or patented system approved by Departmental Representative.

.8 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.

.9 Mechanical splices: subject to approval of Departmental Representative.

.10 Plain round bars: to CSA-G40.20/G40.21

2.2 Fabrication

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada unless indicated otherwise.

.2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 Source Quality Control

.1 Provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcing work.

.2 Inform Departmental Representative of proposed source of material to be supplied.

PART 3 -
EXECUTION

3.1 Preparation

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 Field Bending

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, apply a slow and steady pressure without heat.

.3 Replace bars that develop cracks or splits.

3.3 Placing Reinforcement

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.

.2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Secure all reinforcement steel by means of ties, spacers and supports as required.

.5 Chairs: where concrete is exposed to view, exposed to elements or where rust is possible, use plastic or non-corrosive material, or precast concrete made from concrete of equal strength and durability of concrete to be placed. Chairs used are not to result in voids or unacceptable appearance in exposed concrete surfaces.

3.4 Field Touch-up

.1 Touch up damaged and cut ends of galvanized reinforcing steel with compatible finish to provide continuous coating.

3.5 Cleaning

.2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

PART 1 -
GENERAL

1.1 Basis of Payment .1 No separate payment for Cast-in-place concrete work. Payments for such work to be included in lump sum prices in this Contract.

.3 Include heating of water and aggregates and providing cold weather protection.

.4 Include cooling of concrete and providing hot weather protection.

.5 Include supply and installation of anchor bolts, nuts and washers and bolt grouting.

.6 Include on-site and laboratory testing of concrete by third-party field staff.
.1 Frequency of testing: at least once every 10 m^3 of concrete and in accordance with approved Quality Control Plan.

1.2 References .1 American Society for Testing and Materials (ASTM)
.1 ASTM C 109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
.2 ASTM C 260, Specification for Air-Entraining Admixtures for Concrete.
3 ASTM C309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C 332, Specifications for Lightweight Aggregates for Insulating Concrete.
.5 ASTM C 494, Specification for Chemical Admixtures for Concrete.
.6 ASTM C 827, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
.7 ASTM C 939, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
.8 ASTM D 412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
.9 ASTM D 624, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
.10 ASTM C1017/C1017M-[07], Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
.11 ASTM D 1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural construction (Nonextuding and Resilient Bituminous Types).
.12 ASTM D 1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian Standards Association (CSA)
- .1 CAN/CSA-A5, Portland Cement.
- .2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- .3 CAN/CSA-A23.2, Methods of Test for Concrete.
- .4 CAN/CSA-A23.5, Supplementary Cementing Materials.
- .5 CAN/CSA A362, Blended Hydraulic Cement.
- .6 CAN/CSA A363, Cementitious Hydraulic Slag.
- .7 CAN/CSA A283, Qualification Code for Concrete Testing Laboratories.
- .8 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 Certificates

.1 Submit concrete mix design, sealed by a Professional Engineer registered in the Province of British Columbia in accordance with Section 01 33 00 - Submittal Procedures.

.2 Minimum 4 weeks prior to starting concrete work submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
- .1 Portland cement.
- .2 Blended hydraulic cement.
- .3 Supplementary cementing materials.
- .4 Grout.
- .5 Admixtures.
- .6 Aggregates.
- .7 Water.

.3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.

1.4 Quality Assurance

.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01 45 00 - Quality Control for Departmental Representative's review for following items:
- .1 Falsework erection.
- .2 Hot weather concrete.
- .3 Cold weather concrete.
- .4 Curing.
- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.

1.5 Waste

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste

Management and Disposal

Management and Disposal.

.2 Designate a location for using excess concrete and cleaning out concrete equipment. Prior to concrete pours, obtain approval from the Departmental Representative for the proposed location.

.3 Use trigger operated spray nozzles for water hoses.

.4 Designate a cleaning area for tools to limit water use and runoff.

.5 Carefully coordinate the specified concrete work with weather conditions.

.6 Ensure emptied containers are sealed and stored safely for disposal away from children.

.7 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.8 Choose least harmful, appropriate cleaning method that will perform adequately.

PART 2 - PRODUCTS

2.1 Materials

.1 Portland cement Type 10 with 30% fly ash replacement to CAN/CSA-A5.

.2 Blended hydraulic cement: Type 10 to CAN/CSA-A362.

.3 Supplementary cementing materials: to CAN/CSA-A23.5.

.4 Cementitious hydraulic slag: to CAN/CSA-A363.

.5 Water: to CAN/CSA-A23.1.

.6 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.

.7 Air entraining admixture: to ASTM C 260.

.8 Chemical admixtures: to ASTM C 494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.9 Concrete retarders: to ASTM C 494 water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.

.10 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
- .1 Compressive strength: 32 MPa at 28 days.
- .2 Consistency:
  - .1 Fluid: to ASTM C 827. Time of efflux through flow cone (ASTM C939), under 30s.
  - .2 Flowable: to ASTM C 827. Flow table, 5 drops in 3s, (ASTM C109, applicable portion) 125 to 145%.
  - .3 Plastic: to ASTM C 827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125 %.
  - .4 Dry pack to manufacturer's requirements.
- .3 Net shrinkage at 28 days: maximum 0%.

.11 Do not use calcium chloride.

.13 No chemical substances other than specified herein shall be added to concrete mix or applied to the surface of concrete without Approval by the Departmental Representative.

2.2 Mixes

.1 Design and proportion concrete mix to meet design strength requirements. Include consideration of weather, temperature, curing, shrinkage and methods of concrete placement.

.2 Proportion Type 10 normal density concrete in accordance with CAN/CSA-A23.1, Clause 14 to give the following.
- .1 Minimum compressive strength at 28 days: 32 MPa.
- .2 Maximum water-cement ratio: 0.40
- .3 Calcium chloride or admixtures containing calcium chloride are not to be used in concrete.
- .4 Supplementary cementing materials by weight of Portland cement: silica fume 7.5% to 10%, fly ash up to 20%.
- .5 Minimum cementing materials content: 335 kg/cubic metre.
- .6 Class of exposure: C-1.
- .7 Nominal maximum size of coarse aggregate: 20 mm.
- .8 Slump at time and point of discharge: 80 mm plus or minus 20 mm.
- .9 Air content: 5 to 8 %.
- .10 Air-dry Specific Gravity of 2.3.
- .11 Corrosion inhibitor: Grace "DCI" corrosion inhibitor at 20 L per cubic metre of concrete (in accordance with manufacturers specifications).
- .12 Chemical admixtures: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing. Corrosion-inhibiting admixtures to slow the rate at which chlorides and moisture enter the concrete may be required to reduce the rate of chlorides reacting with reinforcing steel. Super plasticizers require Departmental Representative's approval.

.3 Maintain the temperature at discharge between 10 degrees and 18 degrees Celsius unless approved otherwise by the Departmental Representative.

.4 Certify that the plant, equipment and all materials to be used in concrete comply with the requirements of CAN/CSA A23.1.

.5 Certify that mix proportions selected will provide concrete of specified quality and yield and that strength will comply with CAN/CSA A23.1.

.6 Chemical admixtures other than those specified are to be reviewed by the Departmental Representative prior to their use.

PART 3 - EXECUTION

3.1 Execution

.1 Refer to Master Municipal Specifications, Platinum Edition (2009) Section 03 30 20, Concrete Walks, Curbs and Gutters.

.2 Provide 24 hours' notice to Departmental Representative prior to placing of concrete.

3.2 Field Quality Control

1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report Departmental Representative.

.1 Concrete pours.
.2 Slump.
.3 Air content.
.4 Compressive strength at 7 and 28 days.
.5 Air and concrete temperature.

.2 Appoint and pay for services of a CSA certified testing agency(s), to provide full testing services of sampling and testing of concrete in accordance with CAN/CSA-A23.1 and Section 014500 – Quality Control.

.3 Frequency of testing: at least one set of cylinders for each pour.

.4 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete that they represent.

.5 Inspection and testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

3.3 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

.1 Divert unused concrete materials from landfill to local facility after receipt of written approval from the Departmental Representative.

.2 Provide appropriate area on job site where concrete trucks and be safely washed.

.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental Representative.

.4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.5 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

PART 1 - GENERAL

1.1 Basis of Payment

.1 No separate payment for Cast-in-place concrete work. Payments for such work to be included in lump sum prices in this Contract.

.2 Include heating of water and aggregates and providing cold weather protection.

.3 Include cooling of concrete and providing hot weather protection.

.4 Include on-site and laboratory testing of concrete by third-party field staff.
.1 Frequency of testing: at least once every 10 m^3 of concrete and in accordance with approved Quality Control Plan.

1.2 References

.1 Master Municipal Specifications, Platinum Edition (2009)
.1 Section 03 30 20, Concrete Walks, Curbs and Gutters. Delete clause 1.4, Measurement and Payment, and Clause 2.0, Products.

.2 Section 03 30 00, Cast in place Concrete.

PART 2 - PRODUCTS

2.1 Materials

.1 Concrete to Section 03 30 00, Cast in place Concrete:
Compressive strength: 32 MPa at 28 days.
Air content: 5 to 8 %.
Slump at time and point of discharge: 80 mm plus or minus 20 mm.
Nominal maximum size of coarse aggregate: 20 mm.

PART 3 - EXECUTION

3.1 Work

.1 All work shall be in accordance with Master Municipal Specifications, Platinum Edition (2009) Section 03 30 20, Concrete Walks, Curbs and Gutters.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Electrical Conduits, Section 26 56 01.

.2 Traffic Loop Detectors, Section 26 56 01.1.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-[06], Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 211.1.

.3 CSA C22.2 No. 285.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-[2000], The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

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

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 35 33 – Health and Safety Requirements.

.3 Quality Control: in accordance with Section 01 45 00 - Quality Control:

.1 Provide CSA certified materials.

.2 Where CSA certified material is not available, submit such material to Departmental Representative for approval before delivery to site.

.3 Permits and fees: in accordance with General Conditions of contract.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by a Registered Electrical and Inspection Contractor under provisions of British Columbia Electrical Safety Act.

.3 Underground conduits to be installed by qualified personnel holding an Electrical Safety Branch Restricted Work Qualification (WQ) certificate group 2b (UR) underground raceway installer. (BC Provincial – Electrical Safety.)

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 – Waste Management and Disposal.

1.8 SYSTEM STARTUP

.1 Demonstrate to Departmental Representative that new electrical systems are operating correctly.

.2 Provide these services for such period, and for as many visits as necessary to put system in operation and functioning correctly. Products

1.9 MATERIALS AND EQUIPMENT

.1 Provide material in accordance with Section 01 61 00 - Product Requirements.

.2 Material to be CSA certified. Where CSA certified material is not available, obtain special approval from Departmental Representative before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

1.10 WIRING TERMINATIONS

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

1.11 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying numbers, on both ends of phase conductors of feeders and branch circuit wiring.

Part 2 Execution

2.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

2.2 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Passage of mandrel through conduit.

.2 Carry out tests in presence of Departmental Representative.

.3 Provide equipment and personnel required to conduct tests at conclusion of installation.

2.3 CLEANING

.1 Clean worksite and remove and dispose of unused and surplus materials.

END OF SECTION

Part 1 GENERAL

1.1 MEASUREMENT PROCEDURES

.1 No separate payment shall be made for electrical conduits and junction boxes. Payment for this work shall be included in the lump sum price tendered in in this Contract. Also included in the lump sum price tendered is asphalt, concrete, and grass sod removal and reinstatement to complete this work.

1.2 REFERENCES

.1 Common Work Results for Electrical, Section 26 05 00.

.2 Concrete Walks, Curbs and Gutter, Section 03 30 20.

.3 Aggregates, Section 31 06 16.

.4 Excavating, Trenching, and Backfilling, Section 31 23 33.

.5 Granular Base, Section 32 11 23.

.6 Asphalt Paving, Section 32 12 16.

.7 Topsoil, Section 32 91 21.

.8 Sodding, Section 32 92 23

1.3 Contractor Qualifications

.1 All electrical work to be performed by a Registered Electrical and Inspection Contractor under provisions of British Columbia Electrical Safety Act.

.2 Underground conduits to be installed by qualified personnel holding an Electrical Safety Branch Restricted Work Qualification (WQ) certificate group 2b (UR) underground raceway installer. (BC Provincial – Electrical Safety.)

Part 2 PRODUCTS

2.1 MATERIAL

.1 Rigid PVC Conduit (RPVC):

- Conduit – Rigid Polyvinyl chloride to conform to CSA C22.2 No. 211.1
- Couplings, Adaptors, Bends, and Fittings - Rigid Polyvinyl chloride to conform to CSA C22.2 No. 85
- Cement – CSA certified as recommended by RPVC manufacturer.

.2 Trench Marker Tape. Minimum 100 mm wide, minimum 3.5 mils thick, heavy duty polyethylene. Yellow with black letters displaying "CAUTION – ELECTRICAL LINE BURIED BELOW".

.3 Junction Boxes. Round Plastic Type 10 and 11 to conform to BCMOT E&SMS V1. Lids to be galvanized steel and conform to BCMOT E&SMS V1.

Part 3 EXECUTION

3.1 General

.1 Ensure all permits and approvals are obtained.

.2 Lay out work as shown on the Contract Drawings and confirm locations with Departmental Representative.

.3 Take reasonable precautions necessary to prevent damage to existing utilities. Any damage to be repaired to the satisfaction of the Departmental Representative

3.2 Excavation, Trenching, and Backfilling

.1 Refer to Excavating, Trenching, and Backfilling, Section 31 23 33 for installing conduits and junction boxes.

3.3 Junction Boxes

.1 Install junction boxes as shown on the construction drawings (Sheet 3 of 3, Project No. R078891.001).

.2 Install junction boxes on a clear drain rock base.

.3 Set top of lid flush with finished grade.

.4 Bond steel lids with sufficient slack in wire for lid removal.

3.4 Underground Conduit

.1 Install RPVC underground conduits as shown on the construction drawings (Sheet 3 of 3, Project No. R078891.001).

.2 Place conduits on 75 mm thick granular bedding (19 mm granular base.)

.3 Place 300 mm granular backfill, compact and place marker tape 300 mm above conduit.

.4 Complete backfilling and compaction. Minimum cover over conduits is 600 mm.

.5 Install pull string in all empty conduits and cap at both ends.

.6 Restore surface to original condition where no further work is required.

END OF SECTION

Part 1 GENERAL

1.1 MEASUREMENT PROCEDURES

.1 No separate payment will be made for traffic loops and connections. Payment shall be included in the lump sum price tendered in in this Contract including asphalt cutting and sealing.

1.2 REFERENCES

.1 Common Work Results for Electrical, Section 26 05 00.

.2 Asphalt Paving, Section 32 12 16.

1.3 Contractor Qualifications

.1 All electrical work to be performed by a Registered Electrical and Inspection Contractor under provisions of British Columbia Electrical Safety Act.

.2 Underground conduits to be installed by qualified personnel holding an Electrical Safety Branch Restricted Work Qualification (WQ) certificate group 2b (UR) underground raceway installer. (BC Provincial – Electrical Safety.)

Part 2 PRODUCTS

2.1 MATERIAL

.1 Electrical conductors - No. 14 shielded cable with inductance of 0.72 uH per metre.

.2 Backer Rod – Detector Systems BR-625 or approved equal.

.3 Loop Sealant – ELSRO hot pour crack filler No. 1190, BURFALT 16607 170 Type 2, or approved equal.

.4 Heat Shrink Materials – T&B Shrink-Kon HS 12-6L, installed with T&B WT-14000 Heat Gun.

Part 3 EXECUTION

3.1 General

.1 Ensure all permits and approvals are obtained.

.2 Lay out loop as shown on the Contract Drawings and confirm locations with Departmental Representative. Loop shall be square type measuring 1800 mm X 1800 mm.

.3 Detector loops shall not be installed when the pavement surface is wet or the ambient air temperature is below 5° C. Sealants do not adhere in wet or cold conditions.

3.2 Detector Loops

.1 Cut loop and home run slots in new asphalt. All cuts shall be the same depth using a diamond blade pavement saw. Cuts shall not pass into the gravel base.

.2 Clean the cut slots with a professional grade pressurized water system. Remove all water and dirt from the slot and the 100 mm of surrounding road surface using compressed air. Slot must remain completely clean and dry until after the slot is sealed.

.3 Install four loops of the conductor into the loop slot. Ensure the conductors are tightly wound and pushed to the bottom of the slot. Twist home run conductor at 15 turns per metre. Install 75 mm strips of backer rod every 600 mm to hold conductors in slot.

.4 The conductor must be one continuous wire in the loop, home run, and to the junction box. Splices shall not be allowed in loop conductors.

.5 Install conductor immediately after the slot is cut, cleaned, and dried.

.6 Install loop sealant immediately after the conductor is installed. Loop sealants shall be heated as per the manufacturer's instructions and neatly applied using a narrow spout funnel. Excess sealant on the asphalt surface shall be removed. Add additional sealant to bring the sealant up to finished grade.

.7 After sealing a dust such as Portland cement shall be sprinkled onto the sealant to prevent tracking by vehicles. Excess dust shall be swept off the asphalt surface.

.8 The splices between the loop conductors and the shielded cable are to be soldered and sealed using an approved heat shrink to the following:

- Splices on each pair of wires in a two wire cable shall be offset a minimum distance of 75 mm.
- Strip 37 mm of bare conductor on each wire to be connected, twist together, and solder with 60/40 (tin/lead) resin solder.
- Insulate each solder joint separately using rubber and PVC tape.
- Environmentally seal total splice with approved heat shrink material and approved equipment.

.9 Loop detector resistance to ground shall be greater than 1 Megohm and loop inductance shall detect all motor vehicles.

.10 Loop conductor and shielded cable shall be supported in the junction box from the conductor support conduit.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 31 23 33 - Excavating, Trenching, and Backfilling.
	.3	Section 31 24 13 - Roadway Excavation, Embankment, and Compaction.
	.4	Section 32 11 16 - Granular Sub-Base.
	.5	Section 32 11 23 - Granular Base.
	.6	Section 33 11 16 - Site Water Utility Distribution Piping.
	.7	Section 33 31 13 - Sanitary Utility Sewerage Piping.
	.8	Section 33 41 00 - Storm Utility Drainage Piping.
1.2 References	.1	ASTM; AWWA; CAN – As specified in the contract document
1.3 Source Quality Control	.1	Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
	.2	Inform Department Representative of proposed source and provide samples or access for sampling at least 2 weeks prior to commencing production.
	.3	If, in opinion of Department Representative, 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.
	.4	Should a change of material source be proposed during work, advise Department Representative 2 weeks in advance of proposed change to allow sampling and testing.
	.5	Acceptance of material does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified.
	.6	Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
1.4 Waste Management and Disposal	.1	Divert unused granular materials from landfill to local facility as approved by Department Representative.

PART 2 - PRODUCTS

2.1 Materials	.1	Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five-year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.

.2 All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following gradation limits and 60% of the material passing each sieve must have one or more fractured faces. Determination of the amount of fractured material shall be in accordance with the Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.

2.2 Native Material .1 To be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be approved by the Department Representative. Native material content or compact to specified density.

2.3 Pit Run Gravel .1 To be well graded granular material, substantially free from clay lumps, organic matter and other extraneous material, screened to remove all stones in excess of maximum diameter specified in material description (300 mm Pit Run Gravel, 200 mm Pit Run Gravel, 100 mm Pit Run Gravel). Material to compact to specified density and conform to following gradations:

Sieve Designation	Percent Passing
(300mm dia)	(100)
(200mm dia)	(100)
(100mm dia)	(100)
75mm	100
50mm	70-100
25mm	50-100
4.75mm	22-100
2.36mm	10-85
0.075mm	2-8

Recycled concrete free from contaminated and other extraneous material, conforming to the specified gradations may be used as pit run gravel.

2.4 Pit Run Sand .1 To be well graded pit run sand, free from organic materials and conform to following gradations:

Sieve Designation	Percent Passing
12.5mm	100
4.75mm	35-100
2.36mm	20-70
1.18mm	13-50
0.600mm	8-35
0.300mm	5-25
0.150mm	2-15
0.075mm	0-6

2.5 River Sand .1 River sand, to be used only where shown on Contract Drawings or otherwise specified and approved by Department Representative, to be free of organic material, salt and foreign objects and conform to following gradations:

Sieve Designation	Percent Passing
19mm	100
4.75mm	80-100
0.600mm	20-80
0.150mm	0-20
0.075mm	0-8

2.6 Drain Rock .1 To consist of clean round stone or crushed rock conforming to the following gradations:

	Percent Passing	
Sieve Designation	Course	Fine
25.0mm	100	
19.0mm	0-100	
9.5mm	0-5	100
4.75mm	0	50-100
2.36mm		5-15
1.18mm		15-38
0.600mm		0-8
0.300mm		0-5
0.150mm		0-2
0.075mm		0

.2 Drain rock to be used only where specified on Contract Drawings. Use of drain rock other than as specified requires approval of Department Representative after examination of soils against which drain rock will be placed.

2.7 Granular Pipe Bedding and Surround Material .1 Crushed or graded gravels to conform to following gradations:

	Percent Passing	
Sieve Designation	Type 1*	Type 2*
25.0mm	100	100
19.0mm	90-100	90-100
12.5mm	65-85	70-100
9.5mm	50-75	
4.75mm	25-50	40-70
2.36mm	10-35	25-52
1.18mm	6-26	15-38
0.600mm	3-17	6-27
0.300mm		3-20
0.075mm	0-5	0-8

Type 1* standard gradation
Type 2* to be used only in dry trench conditions and with Departmental Representative's prior approval

Recycled concrete free from contaminated and other extraneous material, conforming to the Type 1 gradations, may be used as pipe bedding and surround material.

.2 Other permissible materials: only where shown on Contract Drawings or directed by Departmental Representative shall drain rock, pit run sand or approved native material be used for bedding and pipe surround.

2.8 Select Granular Sub-base

.1 To be well graded granular material, substantially free from lumps and organic matter, screened if required to conform to following gradations:

Sieve Designation	Percent Passing
75mm	100
25mm	50-85
0.150mm	0-15
0.075mm	0-8

2.9 Crushed Granular Sub-base

.1 To be 75mm crushed gravel conforming to following gradations:

Sieve Designation	Percent Passing
80mm	
75mm	100
38mm	60-100
25.0mm	-
19.0mm	35-80
12.5mm	-
9.5mm	26-60
4.75mm	20-40
2.36mm	15-30
1.18mm	10-20
0.60um	5-15
0.30um	3-10
0.18um	-
0.15um	-
0.075um	0-5

2.10 Granular Base

.1 To be 19mm crushed gravel conforming to following gradations:

Sieve Designation	Percent Passing
19.0mm	100
12.5mm	75-100
9.5mm	60-90
4.75mm	40-70
2.36mm	27-55
1.18mm	16-42
0.600mm	8-30
0.300mm	5-20
0.075mm	2-8

2.11 Recycled Aggregate Material

.1 Aggregates containing recycled material may be utilized if approved by the Department Representative. In addition to meeting all other conditions of this specification, recycled material should not reduce the quality of construction achievable with quarried materials. Recycled material should consist only of crushed Portland cement concrete; other construction and demolition materials such as asphaltic pavements, bricks, plaster, etc. are not acceptable.

PART 3 - EXECUTION

3.1 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.2 Do not use intermixed or contaminated materials. Remove and dispose rejected materials within 48 h of rejection.

3.2 Stockpiling

.1 Aggregates shall not be stockpiled on site but take place at off site locations.

.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 equipment.

.4 Provide compacted sand or crushed gravel base 300 mm min. depth to prevent contamination of aggregate. Do not incorporate this base of pile into work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 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.

.7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.8 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.

END OF SECTION

PART 1 - GENERAL

1.1 Measurement for Payment	.1	No separate payment for clearing and grubbing work. Payments for such work to be included in the lump sum prices in this Contract.
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.
	.2	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.
	.3	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.

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.
3.3 Grubbing	.1	Grub out stumps, roots, and embedded logs to not less than 300 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^3.
3.4 Removal and Disposal	.1	Remove and dispose of all cleared and grubbed material off site.
3.5 Finished Surface	.1	Leave ground surface in condition suitable for stripping of topsoil.

END OF SECTION

PART 1 - GENERAL

1.1 Measurement for Payment

.1 There shall be no separate payment for excavation, trenching, and backfilling. Payment for excavation and backfilling required for culverts and trench drains is included in the lump sum price tendered for this contract.

.2 Contractor to repair portions of roadway damaged (intentionally or not) during construction to Departmental Representative's approval.

.3 No extra payment will be made for excavating unnecessarily beyond lines shown on the drawings.

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 698-00ael, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft) (600 kN-m/m).
- .5 ASTM D 1557-02el, 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 Common excavation: excavation of materials of whatever nature, that are not included under definitions of rock excavation.

.2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.

.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.

1.4 Waste Management and Disposal

.1 Dispose of waste materials in accordance with Section 01 74 21 - Waste Management and Disposal and the Waste Management Work plan.

.2 Place materials defined as hazardous or toxic in designated containers. Ensure containers are sealed and stored safely.

1.5 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, buildings, 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 base as specified in Section 32 11 23.

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 weeds and grasses.

.2 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.

.3 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.

3.6 Excavation .1 Excavate to lines, grades, elevations and dimensions as indicated on the drawings or as required.

.2 Excavation work to be as minimal as possible.

.3 Do not disturb soil within branch spread of trees or shrubs. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.4 Dispose of surplus and unsuitable excavated material in approved location.

.5 Do not obstruct flow of surface drainage or natural watercourses.

.6 Obtain Departmental Representative approval of completed excavation.

.7 Correct unauthorized over-excavation as follows:

.1 Fill under other areas with Type 2 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.

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. 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.

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

PART 1 - GENERAL

1.1 Measurement for Payment	.1	No separate payment shall be made for roadway excavation, embankment and compaction. Payment shall be included in the lump sum price tendered for this Contract and include moving reclaimed material within the site to meet the design elevations, grading, shaping, and compaction.
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	Common Excavation: excavation of materials that are not Rock Excavation or Stripping Excavation.
	.2	Stripping Excavation: excavation of organic material covering original ground.
	.3	Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
	.4	Waste material: material other than Stripping, and unsuitable for embankment construction or material surplus to requirements.
	.5	Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
	.6	Road Reclamation: Full depth road reclamation to a maximum depth 250 mm from existing ground.
1.4 Requirements of Regulatory Agencies	.1	Adhere to Provincial and Federal Environmental requirements if potentially toxic materials are involved.
1.5 Waste Management and Disposal	.1	Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 Materials	.1	Embankment materials require approval by Departmental Representative.
	.2	Embankment material will come from the existing reclaimed road bed if approved by Departmental Representative.

PART 3 - EXECUTION

3.1 Compaction Equipment

.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 Operate compaction equipment continuously in each embankment when placing material.

.3 Care must be taken next to existing structures and next to new structures when performing compaction operations.

3.2 Water Distributors

.1 Apply water with equipment capable of uniform distribution.

3.3 Stripping

.1 Commence topsoil stripping of areas as indicated after weeds and grasses have been removed from these areas.

.2 Strip to depths as indicated or as necessary to remove all organic material. Do not mix topsoil with subsoil.

.3 Stockpile in locations in accordance with Contract Documents or as directed by Departmental Representative.

.4 Dispose of unused stripped topsoil in accordance with Contract Documents or as directed by Departmental Representative.

3.4 Excavating

.1 General:

.1 Notify Departmental Representative if waste materials are encountered. Remove to depth and extent directed.

.2 Compact each layer to minimum 95% standard dry density, and compact top 150mm below sub-excavate to min. 100% max. dry density, to ASTM D698 and ASTM D4718.

.2 Drainage:

.1 Maintain profiles, crowns and cross slopes to provide good surface drainage.

.2 Provide ditches as work progresses to provide drainage.

.3 Construct ditches as shown on plans or as directed.

3.5 Embankments

.1 Full depth reclaim existing road surface prior to moving embankment material.

.2 Move excess material from high points in roadway profile to tow points and to provide cross fall. With Departmental Representatives approval elevations shall be adjusted to eliminate excess material.

.3 Do not place frozen material nor place material on frozen surfaces.

.4 Maintain crowned surface during construction to ensure ready run-off of surface water.

.5 Drain low areas before placing materials.

.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.

.7 Embankments to be sloped to Departmental Representative's requirements. Intent is that slopes be 2% away from buildings or, where there is no building, to provide a 2% crown.

3.6 Subgrade Compaction .1 Break material down using full depth reclamation 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.

3.7 Finishing .1 Shape entire roadbed to provide smooth, uniform surface 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.

3.8 Protection .1 Maintain finished surfaces in condition conforming to this Section until placement of subsequent materials.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

.1 Materials and installation of polymeric geotextiles used in revetments, breakwaters, retaining wall structures, filtration, drainage structures, roadbeds and railroad beds purpose of which is to:

.1 Separate and prevent mixing of granular materials of different grading.

.2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

1.2 Measurement for Payment

.1 No separate payment will be made for geotextiles required for the work. Payment shall be included in the lump sum price for this Contract.

1.3 References

.1 American Society for Testing and Materials International, (ASTM)

.2

.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(April 1997)], Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.

.2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.

.3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No

Compressive Load.

.4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20/G40.21-98, 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 0 33 00 - Submittal Procedures.

.2 Submit to Departmental Representative 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 Diposal .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 Material .1 Geotextile: woven and non-woven synthetic fibre fabric, supplied in rolls.

.1 Composed of: minimum 85% by mass of polypropylene or polyester.

.2 Physical properties of woven geotextile:

.1 Composed of: minimum 85% by mass of polypropylene or polyester.

Property	Unit	AASHTO Survivability	
		Moderate	High
Minimum Thickness	mm	n/a	n/a
Mass per Unit Area	g/m^2	150	150
Grab Tensile Strength	N	1100	1400
Grab Tensile Elongation	%	<50	<50
Puncture	N	400	500
Mullen Burst	kPa	950	1300
Trapezoidal Tear	N	400	500
UB Degradation	% / 500 hrs	50	50
Apparent Opening Size	mm	0.6*	0.6*

*applies to soil with <50% passing the 0.075mm (#200) Sieve

.3 Physical properties of non-woven geotextile:

Property	Unit	AASHTO Survivability	
		Moderate	High
Minimum Thickness	mm	1.5	1.5
Mass per Unit Area	g/m^2	150	150
Grab Tensile Strength	N	500	700
Grab Tensile Elongation	%	50	50
Puncture	N	180	275
Mullen Burst	kPa	950	1300
Trapezoidal Tear	N	180	250
UB Degradation	% / 500 hrs	50	50
Apparent Opening Size	mm	0.25*	0.25*

*Applies to soil with 15 to 50% passing the 0.075mm (#200) sieve

.4 Based on general physical properties of non-woven geotextiles outlined above, equivalent geotextiles would be:

High Survivability: Nelix 4551 or Geotex 601
Moderate Survivability: Nelix 4550 or Geotex 401

.5 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m^{2}to CAN/CSA G164

PART 3 - EXECUTION

3.1 Installation

.1 Prepare slope 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 geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with securing pins.

.3 Place geotextile material smooth in a loose fashion and free of tension stress, folds, wrinkles and creases.

.4 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.5 Overlap each successive strip of geotextile over previously laid strip. Fabric lap for woven is 1.0 m and fabric lap for non-woven is 0.3 m.

.6 Pin successive strips of geotextile with 6 mm diameter steel securing pins fitted with washers at 1.0 m intervals along the overlaps and at mid point of lap or as indicated.

.7 Anchor the top edge of the filter fabric by digging a 0.3 m deep trench, inserting the top edge of the fabric and backfilling with compacted soil.

.8 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.

.9 After installation, cover with overlying 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 geotextliles.

.10 Replace damaged or deteriorated geotextile to approval of Departmental Representative.

.11 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 1.0 m 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

PART 1 - GENERAL

1.1 Measurement for Payment

.1 No separate payment shall be made for Granular Sub-base work. Payments for such work to be included in the lump sum price tendered in this Contract.

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/ft3 (600 kN-m/m3)).

.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/ft3(2,700 kN-m/m3)).

.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:

Sieve Designation	**% Passing**
75 mm	100
25 mm	50 – 100
0.150 mm	0 – 15
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.

PART 3 – EXECUTION

3.1 Sequence of Operation

.1 Place Granular Sub-base after subgrade is inspected and accepted by Departmental Representative.

.2 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.

.3 Compaction Equipment:

.1 Compaction equipment to be capable of obtaining required material densities.

.4 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.

3.2 Site Tolerances

.1 Finished sub-base surface to be within plus or minus 15 mm of established grade and cross section.

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

PART 1 - GENERAL

1.1 Measurement for Payment

.1 No separate payment shall be made for granular base. Payment shall be included in the lump sum price tendered for this Contract.

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/ft3 (600 kN-m/m3)).

.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/ft3(2,700 kN-m/m3)).

.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.

.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:

Sieve Designation	% Passing
19 mm	100
12.5 mm	75 – 100
9.5 mm	60 - 90
4.75 mm	40 – 70
2.36 mm	27 - 55
1.18mm	16 - 42
0.300 mm	8 - 30
0.075 mm	2 - 8

.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 .1 Stockpile Granular Base 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. Place on clean unfrozen surface, properly shaped and compacted, free from snow and ice.

.3 Begin spreading base material on crown line or on high side of one-way slope.

.4 Place material using methods which do not lead to segregation or degradation of aggregate.

.5 Place material to full width in uniform layers not exceeding 100 mm compacted thickness.

.6 Shape layer to smooth contour and compact to specified density before proceeding to paving.

.7 Remove and replace that portion of layer in which material becomes segregated during spreading.

.8 Place granular shoulder material 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.

.9 Place granular tapers at tie ins to gravel roads 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 taper 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 during 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.

3.1 Sequence of Operation

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section or as directed by Departmental Representative.

3.2 Site Tolerances

.1 Maintain finished Granular 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

Part 1 GENERAL

1.1 MEASUREMENT PROCEDURES

.1 No separate payment shall be made for Asphalt Prime Coat. Payment shall be included in the lump sum price tendered in for this Contract.

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 QUALITY ASSURANCE

.1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

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, as specified in Supplementary Specifications.

.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 rate of 2.0 L/m^2 with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m^2.

.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 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 of 2 L/m^2.

.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 of 4.0 L/m^2 emulsified asphalt.

.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.

.1 Control traffic in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.

.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.

.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

Part 1 General

1.1 MEASUREMENT AND PAYMENT

.1 No separate payment for Asphalt Paving work shall be made. Payment shall be included in the lump sum price tendered in this Contract. Weigh tickets shall be provided to the Departmental Representative if requested as the loads are delivered to confirm amounts delivered.

.2 Payment for asphalt saw cutting shall be included in the lump sum price tendered for asphalt paving.

.3 Payment for adjusting of manhole frames and covers and valve adjustments shall be included in the lump sum price for asphalt paving tendered in this Contract.

1.2 REFERENCES

.1 Standard specifications for testing, materials, fabrication, and supply, referred to herein, are fully described is Section 01 42 00 of the Master Municipal Construction Documents Platinum Edition (2009.)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this section.

Part 2 Products

2.1 MATERIALS

.1 Hot mix asphalt supplied shall meet specifications for **MMCD upper course #1** asphalt as described is Section 32 12 16 of the Master Municipal Construction Documents Platinum Edition (2009.)

.2 Upon request, submit supplier's test data and certification that hot mix asphalt meets requirements of this Section 32 12 16, Clause 2.0 of the Master Municipal Construction Documents Platinum Edition (2009.)

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 on Contract Drawings.

.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^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Department Representative, may be used instead of tamping irons.

.3 Straight edges, 3.0 m in length, to test finished surface.

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 paving.

.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 PLANT AND MIXING REQUIREMENTS

.1 The asphalt plant supplying the hot mix asphalt shall meet specifications as described is Section 32 12 16, Clause 3.1 of the Master Municipal Construction Documents Platinum Edition (2009).

3.3 PREPARATION

.1 Reshape granular roadbed.

.2 When paving over existing asphalt surface, clean pavement surface.

.1 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 in accordance with Section 32 12 13.23 - Asphalt Prime Coat and permit prime coat to set prior to paving.

.4 Saw cut existing asphalt pavements at match lines and paint surfaces with asphalt tack.

.5 Adjust man hole frames & covers, and valve boxes to final elevation prior to paving.

.6 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 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 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.

.1 Do not dribble mix into trucks.

.4 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.

.5 Deliver loads continuously in covered vehicles and immediately spread and compact.

.1 Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 125 degrees C.

3.5 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 shown on Contract Drawings.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.

.2 When temperature of surface on which material is to be placed falls below 10 degrees 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 shown on Contract Drawings.

.1 Surface course in 1 layer of 50 mm in general parking areas.

.2 Surface course in 1 layer of 75 mm in bus parking and buss access areas.

.5 Spread and strike off mixture with self propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings.

.1 Departmental Representative to approve lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.

.2 Maintain constant head of mix in auger chamber of paver during placing.

.3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.4 Correct irregularities in alignment left by paver by trimming directly behind machine.

.5 Correct irregularities in surface of pavement course directly behind paver.

.1 Remove excess material forming high spots using shovel or lute.

.1 Fill and smooth indented areas with hot mix.

.2 Do not broadcast material over such areas.

.6 Do not throw surplus material on freshly screeded surfaces.

.6 When hand spreading is used:

.1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.

.1 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.

.1 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.

3.6 COMPACTING

.1 Roll asphalt continuously to average density of not less than 97% of 75 blow Marshall density in accordance with ASTM D1559 with no individual test less than 95%.

.2 Do not change rolling pattern unless mix changes or lift thickness changes.

.1 Change rolling pattern only as directed by Departmental Representative.

.3 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 8 km/h for finish rolling.

.4 Use static compaction for levelling course 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 20 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 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.

.4 Breakdown rolling:

.1 Begin breakdown rolling with vibratory roller 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.

.5 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.

.6 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.

3.7 JOINTS

.1 General:

.1 Remove surplus material from surface of previously laid strip.

.1 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 600 mm.

.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 150 mm.

.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.

.1 If cold joint can not 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 roller, shift roller over onto previously placed lane in order that 100 to 150 mm of drum width rides on newly laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until thoroughly compacted neat joint is obtained

.7 When rolling with vibratory roller, have most of drum width ride on newly placed lane with remaining 100 to 150 mm 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.

.6 Wherever practical, locate joints under future traffic markings (paint lines).

3.8 FINISH TOLERANCES

.1 Finished asphalt surface to provide a smooth driving surface. Adjustments deviating from design elevations shall be approved by Department Representative in advance of paving.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 3 m straight edge placed in any direction.

.3 Water ponding not permitted.

3.9 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 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.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.10 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

Part 1 General

1.1 MEASUREMENT FOR PAYMENT

.1 No separate payment shall be made for pavement marking. Payment shall be included in the lump sum price tendered for this contract.

1.2 REFERENCES

.1 BC Ministry of Transportation and Infrastructure Standard Specifications for Highway Construction, latest edition, Section 321, Traffic Paint.

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

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Low-Emitting Materials: submit listing of paints and coatings to comply with VOC and chemical component limits or restrictions requirements.

1.4 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 off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pavement Markings:

.1 Thermo-plastic markings.

.2 MMA (Methyl Methacrylate).

.2 Glass reflective beads: type suitable for application to wet paint surface for light reflectance.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.

.3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

.1 Applicator: approved distributor capable of applying product in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

.2 Reflective glass beads evenly distribute through product at manufacturers recommended rate.

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 less than 60 km/h and no rain is forecast within next 4 hours.

.3 Apply thermoplastic or MMA evenly at minimum thickness of 2.5 mm (98 mil.)

.4 Symbols and letters to dimensions indicated.

.5 Lines: of uniform colour and density with sharp edges.

.6 Thoroughly clean distributor tank before refilling with product of different colour.

.7 Mix glass beads at rate recommended by the manufacturer uniformly throughout the product prior to application.

3.4 TOLERANCE

.1 Pavement markings: within plus or minus 12 mm of dimensions indicated.

.2 Remove incorrect markings.

3.5 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.6 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until cured / dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

PART 1 - GENERAL

1.1 Measurement for Payment	.1	Payments for relocation of existing information sign mounted on two steel poles shall be included in the lump sum rate tendered in this Contract.
1.2 References	.2	CSA International
		.1 CSAW59 Welded steel construction.

PART 2 – PRODUCTS

2.1 Steel Pipe	.1	48mm diameter X 3.55 wall thickness galvanized steel pipe.

PART 3 - EXECUTION

3.1 Examination	.1	The Contractor review the existing sign as shown on sheet 1 of 3 of the drawings make determination for reinstallation using existing sign supports or replace with new materials if more cost effective.
3.2 Removal and Reinstallation	.1	Remove existing sign and reinstall at new to satisfaction of Departmental Representative.

End of Section

PART 1 – GENERAL

1.1 Introduction

1. Section 32 91 21 refers to those portions of the work that are unique to the supply and placement of growing medium (topsoil) and subsequent finish grading. In this Section, the term "growing medium" is used in place of the generic and commonly used term "topsoil". The term "topsoil" in this Section is used where appropriate to identify imported of on-site natural material conforming to 2.1 of this section. This section must be references to and interpreted simultaneously with all other sections pertinent to the works described herein.

2. This section is based on the "British Columbia Landscape Standard" Published by the B.C. Society of Landscape Architects and the B.C Nursery Trades Association. This standard is intended to set a level of quality which is to be equaled or bettered in the construction documents for each project. Guidance of a registered British Columbia Landscape Architect is recommended.

1.2 Measurement for Payment

.1 No separate payment shall be made for topsoil. Payment will be included in the lump sum price tendered for this contract.

1.3 Related Work

.1 Section 32 92 23 - Sodding

PART 2 PRODUCTS

2.1 Imported Topsoil

.1 Imported topsoil to be friable loam, neither heavy clay nor light sandy nature, containing a minimum of 4% organic matter for clay loams and 2% for sand loams, to a maximum of 20% by volume. To be free from subsoil, roots, noxious grass, weeds, toxic materials, stones over 30mm, foreign objects, and with an acidity range (pH) of 5.5 to 7.5. To be free from crabgrass, coughgrass, equisetum or noxious weeds or seeds of parts thereof.

.2 Freedom from rock or debris to be such that 95 – 100% of particles pass a 25mm sieve and 85 – 100% pass a 9.8mm sieve.

.3 Population of any single species of plant pathogenic nematode to not exceed 1000 per litre of growing medium.

PART 3 – EXECUTION

3.1 Processing

.1 Ensure commercial processing and mixing of growing medium components are done thoroughly by mechanized screening processes. Do not mix by hand. Ensure resulting product is homogeneous mixture having required properties throughout.

.2 Do not prepare or handle topsoil in a wet or frozen condition

3.2 Placing

.1 Place topsoil over prepared subgrade and allow to settle or compact by light rolling such that it is firm against deep footprints. Do not compact growing medium more than necessary to meet this requirement.

.2 Place Ensure topsoil is moist (25% to 75% of field capacity) but not wet when placed, and do not handle if frozen or so wet that its structure will be altered.

.3 Manually spread topsoil around trees, shrubs, and obstacles.
.4 Finish surface smooth, uniform, firm against footprinting with a fine loose surface texture.

3.3 Cleanup

.1 Dispose of surplus materials and all construction debris off site.

END OF SECTION

PART 1 - GENERAL

1.1 Introduction

.1 Section 32 92 23 refers to those portions of the work that are unique to the supply and placement of grassed sod. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

. 2 This section is based on the "British Columbia Landscape Standard" published by the B. C. Society of Landscape Architects and the B. C. Nursery Trades Association.

1.2 Measurement for Payment

.1 No separate payment shall be made for sod required for the work. Payment shall be included in the lump sum prices tendered for this contract.

1.3 Related Work

.1 Section 32 91 21 - Topsoil

1.4 Handling and Storage

.1 Install sod as soon as possible after delivery. If any delay in installation, keep sod moist and cool at all times until installation.

.2 Install sod as soon as possible after delivery. If any delay in installation, keep sod moist and cool at all times until installation

.3 During growing season, install sod within 24 h of delivery to site.

.4 Do not store sod on site more than 3 levels in height.

PART 2 – PRODUCTS

2.1 Sod

.1 Sod to be approved by Departmental Representative and to be nursery grown, true to type, conforming to standards of Nursery Sod Growers' Association and their Nursery Sod Specifications. Sod to be quality, cultured turf grass grown from seed approved by Canada Department of Agriculture, free of diseases, clovers, stones, pests and debris. Sod to be relatively free of weeds, containing no more than two broadleaf weeds or ten annual weeds or weedy grasses per 40 square metres.

.2 Grass mixture in sod to be suited to locality, site conditions, and intended maintenance procedures for each project or area. Sod to be cut by machines designed for that purpose, and by accepted methods, and rolled for shipment. Strips to be 1 square metre - 457 mm wide and 2.19 m long.

.3 When lifted, height of grass in sod to be between 40 mm and 60 mm.

.4 Sod to be lifted in such a manner as to prevent tearing or breaking.

.5 Mowing height limit to be 38 mm to 64 mm and thickness of soil portion of sod to not exceed 25.4 mm or be less than 16 mm.

.6 Grasses in sod to be of sufficient density that no surface soil to be visible when

mowed to height of 38 mm.

.7 Broken, dry, discolored pieces will be rejected by Departmental Representative.

PART 3 - EXECUTION

3.1 Finish Grade Preparation

.1 Do not perform work under adverse field conditions such as frozen soil excessively wet or dry soil or soil covered with snow, ice or standing.

.2 Process Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

.3 Remove and dispose of weeds; debris; soil contaminated by oil, gasoline and other deleterious materials; to approved off-site disposal area.

.4 Loosen surfaces of areas that are excessively compacted by means of thorough scarification, discing or harrowing, to minimum 150 mm depth.

.5 Finish grade smooth to extent required for class of sodding to be carried out, firm against footprints, loose textured, and free of all stones, roots, branches, etc. larger than diameter required for removal for class of sodding to be carried out.

3.2 Sodding

1. Spread growing medium under all sodded areas evenly over approved subgrade to specified depth. See Section 32 91 21 Topsoil and finish Grading.

2. Apply required fertilizer to and work well into growing medium by discing, raking or harrowing, at rates specified. Do within 48 h before laying sod.

3. Lay sod as soon as possible after delivery to prevent deterioration and lay within 24 h of delivery.

4. .4 Lay sod staggered, closely knit together such that no open joints are visible, and no pieces overlap.

5. Lay sod smooth and flush with adjoining grass areas and paving and top surface of curbs unless shown otherwise on Contract Drawings.

6. On slopes of approximately 2:1 and steeper, lay sod lengthwise up slope, and peg every row with wooden pegs at intervals of not more than 0.5 metres. Drive pegs flush with sod.

7. Wooden pegs, for pegging sod on steep slopes, to be lath pegs. Pegs to be of sufficient length to ensure satisfactory anchorage of sod.

8. Where required, place erosion control mesh or netting and secure with stakes or staples sunk firmly into ground to minimum depth of 150 mm at maximum

intervals of 4.5 m along pitch of slope. Place stakes or staples horizontally across slope at intervals equal to width of mesh or netting minus 150 mm and drive flush with top of sod.

9. Protect new sod from heavy foot traffic during laying. Place planks if necessary to prevent damage.

10. Cut sod where necessary only with sharp tools.

11. Roll, tamp, or plank sodded area providing sufficient pressure to ensure good Water sod area immediately with sufficient amounts to saturate sod and upper 100 mm of growing medium.

12. Water sod area immediately with sufficient amounts to saturate sod and upper 100 mm of topsoil.

3.3 Clean-up .1 Remove all materials and other debris resulting from sodding operations from the site.

3.4 Grass Maintenance

1. Begin maintenance for sodded areas immediately after sod has been installed, and continue until issuance of Construction Completion Certificate.
2. Include all measures necessary to establish and maintain grass in a vigorous growing condition, including, but not limited to, following:
3. Mow at regular intervals as required, to maintain grass at maximum height of 60 mm. Do not cut more than 1/3 of blade at any one mowing. Neatly trim edges of sodded areas. Remove heavy clippings immediately after mowing and trimming.
4. Water when required and with sufficient quantities to prevent sod and underlying soil from drying out.
5. Roll when required to remove any minor depressions or irregularities.
6. Undertake weed control when density of weeds reaches 10 broadleaf weeds or 50 annual weeds or weedy grasses per 40 m2 and reduce density of weeds to zero.
7. Immediately repair sodded areas that show deterioration or bare spots. Top-dress all areas showing shrinkage due to lack of watering and seed with seed mix that matches original seed mix.
8. Protect all sodded areas with warning signs, temporary wire or twine fences, or other necessary means.

3.5 Acceptance

1. Departmental Representative will accept the sodding only when following conditions exist:
2. Growing medium quality, fertility levels, depths and surface conditions are as specified in Contract Documents.
3. Grasses are required varieties, free of varieties other than those specified.
4. Grass areas are relatively free of weeds, containing no more than two broadleaf weeds or ten annual weeds or weedy grasses per square metre.
5. Sod is sufficiently established that its roots are growing into underlying growing medium.

6. Sodded areas have been mown at least twice, to a height of 38 mm, last mowing being within 48 h of inspection for acceptance.
7. Grasses established in sufficient density that no surface soil visible when mown to height of 38 mm.
8. Specified maintenance procedures have been carried out.
9. Construction Completion Certificate is issued.

3.6 Guarantee / Maintenance

1. Customary one year guarantee period for construction industry will apply as standard for landscape work. Contractor to guarantee all materials and workmanship for a period of one full year from date of Acceptance, unless specified otherwise in Contract Documents.
2. Guarantee includes replacing all sodded areas determined by Departmental Representative to be dead or failing at end of guarantee period. Replacements to be made at next appropriate season, and conditions of guarantee will apply to all replacement seeding for one full growing season.
3. Guarantee will not apply to sodded areas damaged after date of Acceptance by causes beyond Contractor's control, such as vandalism, "acts of God", "excessive wear and tear", or abuse. Contractor is responsible for work until Acceptance. After Construction Completion Certificate, Owner is responsible for work and proper maintenance.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections
.1 Section 01 33 00 - Submittal Procedures.
.2 Section 31 23 33 - Excavating, Trenching and Backfilling.
.3 Section 33 31 13 - Sanitary Utility Sewerage Piping.
.4 Section 33 41 00 - Storm Utility Drainage Piping.

1.2 References
.1 American Society for Testing and Materials International (ASTM)
.1 ASTM A 48/A 48M, Standard Specification for Gray Iron Castings.
.2 ASTM C 117, Standard Test Method for Materials Finer than 75-µm Sieve in Mineral Aggregates by Washing.
.3 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.4 ASTM C 139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
.5 ASTM C 478M, Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].
.6 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

.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 International)
.1 CAN/CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.2 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
.1 CSA-A3001, Cementitious Materials for Use in Concrete.
.2 CSA-A3002, Masonry and Mortar Cement.
.3 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
.4 CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.
.5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

1.3 Submittals
.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.4 Delivery Storage
.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 Materials
.1 Concrete:
.1 to Section 03 30 00 - Cast-In-Place Concrete.
.2 concrete to be minimum 20 MPa or as specified otherwise on Contract

Drawings.

.2 Concrete reinforcement: to Section 03 20 00-Concrete Reinforcing.

.3 Precast manhole sections: to ASTM C 478M, complete with ladder rungs.

.4 Precast "Tee" Sections: precast "Tee" sections constructed as an integral component of mainline pipe will be acceptable where shown on Contract Drawings as an approved alternative.

.5 Manhole lids: to be precast reinforced concrete designed to withstand H20 loading.

.6 Cast iron frame and cover: as shown on Contract Drawings.
- .1 Frame and cover must conform to ASTM A48 and be designed to withstand H20 loading.
- .2 Frame and cover must bear manufacturer identification on castings.

.7 Ladder rungs to be:
1. As shown on Contract Drawings.
2. To conform to ASTM C-497, C-478 load test
3. 20 mm cold rolled steel, hot dipped after bending to CSA G164, welded to reinforcing bars and cast with manhole sections or epoxy grouted into manhole walls.
4. 20 mm aluminum alloy #6351-T6 (CSA-S157 and NBC 1977), complete with polyethylene anchor insulating sleeves and installed in 25 mm or 26 mm precast or drilled holes in manhole sections.
5. Polypropylene encased steel ladder rungs: polypropylene ASTM-D-4101 steel core to be ½ inch dia grade 60 per ASTM A615M.
6. Distance from top of manhole cover to top rung to be maximum 500 mm where no handhold provided. Maximum distance may be extended to 660 mm where handhold provided.
7. In compliance with all requirements of Workers' Compensation Board.

.8 Safety platform: to be installed as shown on Contract Drawings in all manholes in excess of 6 m deep. Approval of Departmental Representative is required prior to installation.

.9 Precast catch basin sections: to ASTM C478M.

.10 Catchbasin leads to be minimum 150 mm diameter and of PVC DR28.

.11 Catchbasin lids: to be precast reinforced concrete designed to withstand H20 loading.

.12 Cast iron catchbasin frame and grate: Dobney B23 and B24 or approved by Departmental Representative equivalent.
1. Frame and grate must conform to ASTM A48 and be designed to

withstand H20 loading.

2. Frame and grate must bear manufacturers identification on casting.

.13 Joints: made watertight using rubber rings to ASTM C443 or cement mortar.

.14 Mortar:
- .1 Aggregate: to CSA A82.56.
- .2 Masonry Cement: to CAN/CSA-A8.

.15 Adjusting rings: to ASTM C 478.

.16 Concrete Brick: to CAN3-A165 Series.

.17 Drop manhole pipe: to be as shown on Contract Drawings.

.18 Overbuilt manholes to be: as shown on Contract Drawings.

.19 Concrete bags to be: Jute, burlap or synthetic bag of suitable size and texture filled to 2/3 capacity with mixture of 1 part Portland cement to 2 parts sand, thoroughly mixed, and weighing approximately 27 kg.

.20 Concrete blocks: to be H type concrete construction blocks conforming to latest ASTM Specifications.

.21 Prebenched manhole bases:
- .1 Where precast manhole sections are incorporated into precast base by bonding to concrete benching, use precast reinforced concrete manhole sections to ASTM C478 complete with ladder rungs above benching.
- .2 Where base benching is cast monolithically with manhole walls, reinforce wall and joint sections as specified in ASTM C478.
- .3 Precast concrete base section minimum thickness to be 120 mm, measured from underside of base to lowest point in concrete channeling.

PART 3 - EXECUTION

3.1 Excavation and Backfill .1 Excavating and backfilling in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

3.2 Concrete Work .1 Place concrete reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.

.2 Do concrete work in accordance with Section 03 30 00 - Cast-In-Place Concrete.

3.3 Manhole Installation .1 Install manholes as shown on Contract Drawings, concurrently with pipe laying.

.2 Ensure excavation free of water prior to placing concrete.

.3 Place minimum 100mm of 25mm bedding gravel compacted to minimum 95% Modified Proctor density in compliance with ASTM D1557.

.4 Construct base to ensure first precast riser section is set plumb.

.5 Set all inlet and outlet pipes to specified alignments and elevations.

.6 Connect concrete pipe into manhole using spigot or bell precast into manhole wall or, alternatively, grout pipe into pre-formed rough core in manhole wall using fast-setting grout.

.7 Connect PVC pipe into manhole using "manhole adapter ring" or approved equal.

.8 Ensure placement of concrete does not disturb connecting pipes.

.9 Set remaining precast riser sections plumb with joints consisting of cement mortar or gaskets to ASTM C443.

.10 Where possible, for channeling using half-sections of pipe or suitable fittings. Bench to direct flow parallel to main flow of sewer. From top of benching as high as crown of sewer pipe. Finish concrete to smooth surface using steel trowel.

.11 Brace capped inlets or stubs to withstand testing head.

.12 Set frames by firmly embedding in mortar on minimum of 1, maximum of 3 courses of bricks or precast concrete riser rings, or cast-in-place form system with due regard to maximum distance to first step.

.13 "Butter" inside and outside faces of bricks with mortar to ensure neat even finish. Grout inside, outside and between courses of bricks or grade rings with mortar to ensure neat even finish. Pre-wet all joints before placing mortar.

.14 Plug lifting holes in pipe.

.15 Install drop structures where required to Contract Drawings.

.16 Ensure frames conform to design contour of pavement or existing surface.

3.4 Cleanout Installation .1 Install cleanouts as shown on Contract Drawings, to standards and installation procedures described in 3.3.

3.5 Catchbasin Installation .1 Install catchbasins as Shown on Contract Drawings, to general standards and installation procedures described in 3.3.

.2 Place minimum of 100 mm bedding gravel under base, compact to 95% Modified Proctor density.

.3 Install catchbasin leads in accordance with Section 33 41 00-Storm Utility Drainage Piping.

3.6 Adjusting Tops Of Existing Units

.1 Remove existing gratings, frames and store for re-use at locations specified.

.2 Precut units:

.1 Raise or lower precast units by adding or removing precast sections as required.

.2 When amount of raise is less than 300 mm use standard manhole bricks, precast riser rings or Cast-in place form system.

.3 Cast-in-Place units:

.1 Raise cast-in-place units by roughening existing top to ensure proper bond and extend to required elevation with cast-in-place concrete.

.2 Lower cast-in-place units with straight walls by removing concrete to elevation indicated for rebuilding.

.3 Install additional manhole ladder rungs in adjusted portion of units as required.

.4 Re-use existing gratings, frames.

.4 Re-set gratings and frames to required elevation on not more than 3 courses of brick. Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.

.5 Ensure adjustments conform to requirements regarding distance to first step.

3.7 Remove Existing Units .1 Remove existing structures where shown on Contract Drawings. Backfill in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

3.8 Leakage Test .1 Perform leakage testing of sanitary manholes in accordance with Section 33 31 13 - Sanitary Utility Sewerage Piping.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes
.1 Materials and installation for water mains, valves, valve boxes, and valve chambers, service connections and irrigation lines.

1.2 Related Sections
.1 Section 01 33 00 - Submittal Procedures.
.2 Section 31 23 33 - Excavating, Trenching and Backfilling.
.3 Section 33 05 13 - Manholes and Catch Basin Structures
.4 Section 03 20 00 - Concrete Reinforcing
.5 Section 03 30 00 - Cast-In-Place Concrete.

1.3 Measure for Payment
.1 No separate payment shall be made for supply of materials or installation of the water system. Payment for this material and work shall be included in the lump sum prices tendered for this contract.

1.4 References
.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
.1 ANSI/AWWA B300-[99], Hypochlorites.
.2 ANSI/AWWA B301-[99], Liquid Chlorine.
.3 ANSI/AWWA C500-[02], Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
.4 ANSI/AWWA C651-[99], Disinfecting Water Mains.
.5 ANSI/AWWA C800-[01], Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
.6 ANSI/AWWA C900-[97], Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 100 mm - 300 mm, for Water Distribution.

.2 American Society for Testing and Materials International, (ASTM)

.3 American Water Works Association (AWWA)/Manual of Practice

.4 Canadian Standards Association (CSA International)

1.5 Material Certification
.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Products having CSA certification to be used where readily available. Certification by Standards Council of Canada approved independent third body that products conform to CSA standards in acceptable in lieu of CSA certification.

.3 At least 2 weeks prior to commencing work, submit manufacturer's recent test data and certification that materials to be incorporated into works are representative and meet requirements of this Section. Include manufacturer's drawings where pertinent.

1.6 Record Drawings
1. Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, maintenance and operating instructions.

1.7 Scheduling of Work

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by the Departmental Representative.

.3 Notify the Departmental Representative minimum of 24 hours in advance of interruption in service.

.4 Do not interrupt water service for more than 3 hours and confine this period between 09:00 and 16:00 h local time unless otherwise authorized.

.5 Notify fire department of any planned or accidental interruption of water supply to hydrants.

PART 2 - PRODUCTS

2.1 General

.1 Only one type of pipe material will be allowed throughout contract unless specified otherwise or shown otherwise on Contract Drawings, excluding main pipe within chambers which shall be brass.

.2 All products are specified by reference to approved specifications and/or standards.

2.2 Mainline Pipe, Joints and Fittings

.1 Polyvinyl Chloride (PVC) Pressure Pipe:

.1 Pipe:

.1 Pipe to be manufactured to specifications for pipe size ranges as follows:
- Pipes 100 to 300mm dia. - AWWA C900
AWWA C900 pipe to Pressure Class or AWWA C905 pipe to pressuring rating PC350. Pipes to be certified by Canadian Standards Association for pipe size ranges below:
- Pipes 100 to 1200mm dia. - CSA B137.3.

.2 ULC listed.

.3 Cast iron pipe equivalent outside diameter.

.4 To be compatible with specified mechanical joint and push-on joint fittings and valves without use of special adapters.

.1 Joints: Push-on integrally thickened bell and spigot type to ASTM D 3139 with single elastomeric gasket to ASTM F477.

.2 High Density Polyethylene Pipe:

.1 Pipe:

.1 To AWWA C906 pressure class PC350.

.2 Iron pipe size equivalent outside diameter.

.3 To be Compatible with specified mechanical joint fittings and valves without special adapters.

.4 Joints: Heat butt fusion to ASTM D2657 and in accordance with manufacturers recommendations.

.5 Fittings:

.1 Fabricated HDPE mitred fittings to AWWA C906 suitable

for pressure rating specified on Contract Drawings.

.2 Moulded HDPE fittings to ASTM 3261 suitable for pressure rating specified and fusion to main pipe.

.3 Nuts and bolts as specified for "Fittings" in this section.

.3 Fittings:

.1 Gray-iron (cast iron) fittings to ANSI/AWWA C110/A21.1O-93 suitable for 1035 kPa minimum pressure rating.

.2 Ductile iron fittings to AWWA C110 suitable for pressure rating of 2415 kPa, cement mortar lined to AWWA C104.

.3 Compact ductile iron fittings to ANSI/AWWA C153/A21.53-94 suitable for pressure rating of 2415 kPa, cement mortar lined to AWWA C104.

.4 PVC injection-molded fittings shall be C900, DR18, Class 150 conforming to AWWA C-907 and CAN/CSA-Bi 37.3-93.

.5 PVC extruded fittings shall be Class 150, DR 18 conforming to AWWA C900-89

.6 Single rubber gasket for push-on bell and spigot type joint and/or mechanical pipe joints; to AWWA C111. All push-on joint hubs to be equipped with tie-rod lugs.

.7 Bolts and nuts:

.1 Bolts to be carbon steel, Grade B to ASTM A307, heavy hex style, zinc plated to ASTM B633 or cadmium plated to ASTM B766. Bolt sizes to AWWA C110.

.2 Nuts and washers: Nuts to be carbon steel, Grade A to ASTM A563. Washers to be flat hardened steel to ASTM F436. Nuts and washers to be zinc plated to ASTM B633 or cadmium plated to ASTM B766.

.8 Couplings:

.1 General Requirements:

.1 Suitable for pressure class PC350.

.2 To AWWAC219

.3 Anti-corrosion coating of interior and exterior centre sleeve and end rings to AWWA C219, AWWA C213, AWWA C210, or AWWA C550 as specified in Contract Documents.

.4 Compression gaskets to AWWA C219.

.5 Bolts and nuts high strength low alloy steel to AWWA Cl11, stainless steel to ASTM F593 or F738 for bolts and ASTM F594 or F836M for heavy hex nuts. Rolled threads, fit and dimensions to AWWA Cl11.

.9 Repair clamps shall be constructed of 18-8 stainless steel passivated for corrosion resistance. Stainless steel components shall be Type 304 or 304L. All surfaces including weld areas shall be thoroughly cleaned of scale, grease or other contaminants. Welding must be performed in a controlled environment to prevent sensitization. Nuts and bolts shall be Type 304 18-8 stainless steel 5/8 X 11 NC rolled thread lubricated to prevent galling. Gasket shall be SBR (Buna) rubber per ASTM D2000.

2.3 Valve and Valve Boxes

.1 Valves - General Requirements:
- .1 Valves to open counter-clockwise.
- .2 All valves to have manufacturer's name, year of manufacture, size and working pressure on the bonnet or body.

.2 Service Valve Boxes:
- .1 Curb stop valve boxes (as shown on drawings) on 32 mm to 50 mm diameter services to be telescoping assembly comprised of threaded cast-iron top with bronze pentagon centre plug, 25 NPS iron pipe, cast iron base allowing threaded insertion of 25 NPS pipe and accommodation for curb stop valve (cast iron base section may thread onto curb stop valve) and 19 mm diameter steel operating rod attached to curb stop valve with bronze cotter pin, as specified on Contract Drawings.

.3 Check Valves:
- .1 To AWWA C508: 50 to 300 mm to working pressure1200 kPa; 400 to 500 mm to working pressure 1035 kPa; gray cast iron or ductile cast iron body, clear waterway type, metal to metal seat, mechanical joint ends to AWWA C111 or flanged ends to AWWAC110.

2.4 Valve Chambers

.1 Applicability: for check valves and hose bib connections.

.2 As specified on Contract Drawings, precast concrete and steel covers

.3 Precast concrete sections to ASTM C478M. Ladder rungs be cast integral with unit; field installation not permitted. Precast concrete lids to H-20 loading conditions.

.4 Jointing materials:
- .1 Manufacturer's rubber ring gaskets,
- .2 Mastic joint filler,
- .3 Cement mortar or,
- .4 Combination of above types.

.5 Mortar: aggregate to CAN/CSA AS2.56, masonry cement to CAN/CSA A8.

.6 Valve chamber frames and covers: as specified on Contract Drawings.

2.5 Irrigation Pipe, Joints and Fittings

.1 To AWWA C906 pressure class PC350.

.2 Pipe diameter 50 mm HPDE SDR 11.

.3 Joints:
- .1 Heat butt fusion to ASTM D2657 and in accordance with manufacturers recommendations.

2.6 Underground Service Line Valves and Fittings

.1 Underground service line valves and fittings 19 to 50mm to AWWA CSOO suitable for 1035 kPa working pressure.

.2 Corporation Stops:
- .1 19 to 50 mm: bronze to ASTM B62, AWWA thread inlet, compression type outlet.
- .2 To be as specified on Contract Drawings.
- .3 Curb Stops:
  - .1 37 and 50 mm to be bronze to ASTM 862; ball or cylinder type construction utilizing rubber O-ring seals.
  - .2 To be full flow, full port, as specified on Contract Drawings.
  - .3 Fittings: to be compression type for underground services.
  - .4 All fitting and valve connections on polyethylene to have solid fluted stiffening liners manufactured from stainless steel to ANSI T304 designed for the appropriate type and inside dimension of pipe, warranted by the manufacturer for that use.

2.7 Granular Pipe Bedding and Surround Material

1. As shown on Contract Drawings.
2. Refer to Section 31 05 16 - Aggregate Materials.

2.8 Backfill Material

1. As shown on Contract Drawings.
2. Refer to Section 31 05 16 - Aggregate Materials.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Remove defective materials from site.

3.2 Trenching

.1 Do trenching work in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.

.2 Trench alignment and depth as shown on Contract Drawings.

.3 Trench depth to provide cover over pipe of not less than 1.0 m from finished grade unless shown otherwise on Contract Drawings.

3.3 Granular Bedding

.1 Fill over-excavation below design elevation of bottom of specified bedding with granular bedding placed and compacted in accordance with Section 31 23 33. Drain rock may be used for backfill of over-excavation only with the Departmental Representative's approval.

.2 Place granular bedding material across full width of trench bottom in uniform layers to depth shown on Contract Drawings.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe. Do not use blocks when bedding pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to minimum 95% Modified Proctor Density in compliance with ASTM D1557. (All following references to density imply in compliance with ASTM D1557).

.6 Use imported bedding material for all water wipe in this contract unless directed otherwise by Departmental Representative.

3.4 Pipe Installation

.1 Handle pipe in accordance with pipe manufacturer's recommendations. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.2 Lay and join pipes to manufacturer's instructions and specifications except as noted otherwise herein. PVC pipe to AWWA M23 and C605.

.3 Horizontal tolerance: plus or minus 50 mm from specified alignment. Vertical tolerance: plus or minus 25 mm from specified grade.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.6 Do not exceed maximum joint deflection specified in AWWA C600 nor maximum joint deflection recommended by pipe manufacturer. Joint deflection not permitted for PVC pipe. Deflections in PVC pipelines in excess of those allowed above to be achieved using high deflection PVC couplings rated for 1380 kPa operating pressure.

.7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of water and foreign materials.

.8 Position and join pipes with equipment and methods specified in 3.4.10.

.9 Cut pipes as required, as recommended by pipe manufacturer, without damaging pipe or its coating and leave smooth end at right angles to axis of pipe.

.10 Joints:

- .1 Install gaskets as recommended by manufacturer.
- .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .3 Align pipes carefully before joining.
- .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
- .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
- .6 Complete each joint before laying next length of pipe.
- .7 Minimize joint deflections after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.9 Butt-fuse high density polyethylene in strict accordance with manufacturer's instruction by manufacturer or by manufacturer trained personnel.

.10 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as specified otherwise.

.11 When any stoppage of work occurs, restrain pipes in an approved manner to prevent "creep" during down time.

.12 Recheck components assembled above ground after placing in trench to ensure that no movement of joints has taken place.

.13 Test and/or bleed points consisting of Corporation cocks, sized to achieve minimum flushing velocities of 0.8 m/s in accordance with AWWA C651. to be provided where shown on Contract Drawings or as required by Contractor for pressure testing and flushing.

3.5 Valve Installation

.1 Install valves to manufacturer's recommendations at locations shown on Contract Drawings.

.2 Support valves located in valve boxes by means of either concrete or pressure treated and end treated wood blocks, located between valve and solid ground. Maximum length of pipe on each end of valve to be 1m. Valves not to be supported by pipe.

.3 Support valves located in valve chambers by means of either concrete blocks or fabricated steel pipe stands as shown on Contract Drawings.

.4 Valves to be installed in vertical position with actuating stem plumb.

3.6 Valve Chambers

.1 Precast units as shown on Contract Drawings. Precast units to be in accordance with Section 33 05 13 - manholes and Catch Basin Structures.

.2 Construct units as shown on Contract Drawings, plumb and with valve chamber openings centered over valve nut, true to alignment and grade. Valve chambers not to rest on pipe.

.3 Set precast concrete slab on 100 mm minimum of compacted granular material and levelling bricks where shown on Contract Drawings.

.4 Plug lifting holes with precast concrete plugs set in non-shrink non-staining grout or non-shrink, non-staining mortar.

.5 Set valve chamber to correct grade to ensure cover is to required elevation without use of adjustment rings.

.6 Cover to be marked as specified on Contract Drawings.

.7 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

.8 Set valve boxes centrally over valve nut. Set valve boxes and any other boxes

around appurtenances. Complete backfill within 24 h of setting appurtenance.

.9 Install 100 mm sump drain to manufacturer's instructions and to AWWA C510 and AWWA C511 complete with backflow prevention valve.

3.7 Thrust Blocks

.1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers hydrants and fittings and undisturbed ground as shown on Contract Drawings or as directed by Departmental Representative.

.2 Place 6 mil polyethylene between interface of concrete and fitting.

.3 Do concrete work in accordance with Section 03 30 00-Cast-In-Place Concrete.

.4 Keep joints and couplings free of concrete.

.5 Do not backfill over concrete within 24 h after placing.

3.8 Pipe Surround

.1 Upon completion of pipe laying and after the Department Representative has inspected work in place, surround and cover pipes as shown on Contract Drawings.

.2 Hand place surround material in uniform layers simultaneously on both sides of pipe. Do not dump material within 1 m of exposed pipe.

.3 Compact each layer from pipe invert to underside of backfill to minimum 95% Modified Proctor Density

3.9 Backfill

.1 Place and compact backfill material in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling

.2 Backfill requirements, including type of material and compaction requirements as shown on Contract Drawings.

3.10 General Procedure Flushing, Testing and Disinfection

.1 All cleaning, flushing, pressure and leakage testing, disinfection and final flushing to be done by Contractor. Costs are included in the Lump Sum price tendered for this Contract.

.2 Perform all tests in presence of Department Representative. Notify Departmental Representative 24 h in advance of proposed test.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.4 Obtain Departmental Representative approval prior to discharging flushing water to sewers or drainage ditches.

.5 Comply with Section 01 35 43 - Environmental Procedures

.6 Provide Departmental Representative with all required approvals.

3.11 Cleaning and Preliminary Flushing

.1 Before flushing and pressure testing, ensure waterworks system is completely finished except tie-ins to existing watermains and make arrangements with the Departmental Representative for scheduling of testing and disinfection of mains. Testing and disinfection to be witnessed by the Departmental Representative.

.2 Isolation of existing water system where required will be performed by Department. Do not operate any existing valves without Departmental Representative's authorization.

.3 Water may be supplied from fire hydrants upon application for a Hydrant Use Permit and presentation of valid test certificate for reduced pressure principle backflow prevention device conforming to AWWA C511.

.4 Remove foreign material from pipe and related appurtenances by flushing with water. Main to be flushed at water velocities as high as can be obtained from available water sources. Minimum velocity to be 0.8 m/s and/or in accordance with AWWA C651. Continue flushing at least until flow from most distant point has reached discharge point and until water discharged is clean and clear.

3.12 Testing Procedures

.1 Upon completion of construction of any section, which shall be defined as that pipeline and appurtenances located between any two adjacent line valves, make section ready for testing. Carry out testing in accordance with 3.13 following.

.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 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 millimetre diameter of pipe per kilometre per (24-hour period). Minimum duration of test period to be 2-hours. Maximum test pressures should not exceed those specified in CSA 8137.3 - Table 9.

.4 Perform pressure and leakage testing of polyvinyl chloride (PVC) piping to AWWA M23 and AWWA C605.

.5 Should any test disclose excessive leakage, repair or replace defect and retest section until specified testing requirement is achieved.

3.13 Disinfection, General

.1 After Departmental Representative has certified that pipes and appurtenances have passed all specified tests, flush and disinfect pipes and appurtenances. Disinfect and flush in accordance with 3.14 following.

3.14 Disinfection and Flushing Procedures

.1 Do not use granular hypochlorite for disinfection of PVC pipe with solvent welded joints, as there is an explosive reaction potential.

.2 Retain water containing not less than 25 mg/L free chlorine in water system for a period of at least 24 h, in accordance with AWWA C651, Continuous Feed Method. Submit outline of proposed disinfection procedure accompanied by marked up schematic drawing to Department Representative for approval 48 h in advance of commencement of disinfection.

.3 Allow water from existing distribution system, isolated by reduced pressure principle backflow prevention device or other approved source of supply, to flow at constant, measured rate into newly laid watermain. In absence of a meter, rate may be approximated by methods such as placing Pilot gauge in discharge, measuring time to fill container of known volume, or measuring trajectory of discharge and using formula presented in AWWA C651.

.4 At a point not more than 3 m downstream from beginning of new main, ensure water entering new main receives dose of chlorine fed at constant rate such that water will have not less than 25 mg/L free chlorine. To assure that this concentration is provided, measure chlorine concentration at regular intervals as specified in AWWA C651.

.5 Amount of chlorine required to produce 25 mg/L concentration in 30 m of pipe of various sizes is given in following table:

Pipe Size (mm)	100 Percent Chlorine (kg)	1% Chlorine Solution (Litres)
100	0.006	0.61
150	0.014	1.36
200	0.024	2.46
250	0.039	3.86
300	0.054	5.45
400	0.098	9.85

.6 Allow flow of water containing chlorine to continue until entire main, all service connections, extremities and hydrants to be treated are filled with 25 mg/L chlorine solution. To ensure that this concentration has been attained throughout, measure free chlorine residual at a number of points and extremities along main. Retain chlorinated water in main for at least 24 h. During this time operate all valves, curb stops and hydrants in section treated in order to disinfect them thoroughly.

.7 At end of this 24 h period, treated water to contain no less than 10 mg/L free chlorine throughout main. If chlorine content is less than 10 mg/L repeat chlorination procedure until specifications are met.

.8 After completion of chlorination, flush chlorinated water from the system and services until chlorine concentration in remaining water is less than 0.3 mg/L chlorine residual.

.9 Upon completion of disinfection and flushing, Contractor to remove test and bleed point apparatus and backfill and complete any other work required for placing of waterworks system in service.

.10 After the water system has been tested, disinfected, flushed and accepted by the Departmental Representative pressure shall be relieved from the lines. The lines shall remain full of chlorinated water for the system to be completed by others.

3.15 Connections to Existing Mains

.1 There shall be no connections to the existing water system under this Contract. The Contractor shall place blue painted 38 X 89 mm wood markers to mark the end of each run of water line.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes
.1 Materials and installation for gravity sewers.

1.2 Related Sections
.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 78 00 - Closeout Submittals.
.3 Section 03 30 00 - Cast-In-Place Concrete.
.4 Section 31 05 16 - Aggregate Materials.
.5 Section 31 23 33 - Excavating, Trenching and Backfilling.
.6 Section 33 05 13 - Manholes and Catch Basin Structures.

1.3 References
.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.2 American Society for Testing and Materials International, (ASTM)
.1 ASTM C 117-95, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
.2 ASTM C 136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.3 ASTM C 443M-02, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
.4 ASTM D 698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).
.5 ASTM D 3034-00, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
.6 ASTM D 3350-02, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.4 Canadian Standards Association (CSA International)
.1 CAN/CSA-A3000-98, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
.1 CAN/CSA-A5-F98, Portland Cement.
.2 CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
.1 CSA B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
.2 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
.4 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

1.4 Definitions
.1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.5 Material Certification
.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Products having CSA certification to be used where readily available. Certification by Standards Council of Canada approved independent third body that products conform to CSA standards in acceptable in lieu of CSA certification.

.3 At least 2 weeks prior to commencing work, submit manufacturer's recent test data and certification that materials to be incorporated into works are representative and meet requirements of this Section. Include manufacturer's drawings where pertinent.

1.6 Delivery, Storage and Handling .1 Deliver, store and handle materials in accordance with manufactures recommendations.

1.7 Waste Management and Disposal .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Divert unused concrete materials from landfill to local facility as approved by Department Representative.

.3 Divert unused aggregate materials from landfill to facility for reuse as approved by Department Representative.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Fold up metal banding, flatten and place in designated area for recycling.

1.8 Scheduling .1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to approved schedule.

PART 2 - PRODUCTS

2.1 Plastic Pipe .1 Polyvinyl chloride pipe up to 675mm in diameter, DR35. Pipe to have minimum pipe stiffness (F/Y) of 320 kPa at 5.0% deflection, ASTM D2412. Pipe to be manufactured to ASTM D3034.

.2 Pipes to be certified by Canadian Standards Association standard CSA B182.2

.3 Joint: Pipe to include integral bell and spigot ends with stiffened wall section and formed groove for a rubber gasket; joints to conform to ASTM D3212, gaskets to ASTM F477.

.4 Normal pipe length joint to joint to be 4.0 m.

.5 Maximum deflection not to exceed 7.5% of the base inside diameter.

2.2 Concrete

.1 Concrete mixes and materials required for bedding cradles, encasement, and incidental uses: to Section 03 30 00 - Cast-in-Place Concrete.

.2 Concrete to be minimum 20 MPa.

2.3 Pipe Bedding and Surround Material

.1 Granular material in accordance with Section 31 05 16 - Aggregate Materials

.2 Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.5 Backfill Material

.1 As shown on Contract Drawings.

.2 In accordance with Section 31 05 16-Aggregate Materials.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching

.1 Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Do not allow water or sewage to flow into trench.

.3 Trench alignment and depth as shown on Contract Drawings.

3.3 Concrete Bedding and Encasement

.1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as indicated.

.2 Position pipe on concrete blocks to facilitate placing of concrete.

.1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 h after placing.

3.4 Granular Bedding

.1 Fill over-excavation below design elevation of bottom of specified bedding with granular bedding placed and compacted. Drain rock may be used for backfill of over-excavation only with Department Representative's approval.

.2 Place granular bedding material across full width of trench bottom in uniform layers not exceeding 150mm compacted thickness to depth as shown on Contract Drawings.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% Modified Proctor Density in compliance with ASTM D1557. (All following references to density imply in compliance with ASTM D1557).

3.5 Installation

.1 Handle pipe in accordance with manufacturer's recommendations.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.2 Lay and join pipes to manufacturer's instructions and specifications except as noted otherwise herein. PVC pipe to CSA B182.11.

.3 Horizontal tolerances: ± 50 mm from specified alignment Vertical tolerances: ± 10 mm from specified grade. Reverse grade is not acceptable.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Pipes on curved alignments:

.1 Smooth PVC pipe: for 100 mm to 300 mm sizes conform to required curvature by bending pipe barrel. In no case shall radius of curvature to be less than 300 times outside diameter of pipe barrel. Joint defection not permitted for smooth profile PVC pipe.

.7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Cut pipes as required, as recommended by pipe manufacturer, without damaging pipe and leave smooth end at right angles to axis of pipe.

.10 Joints:

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign

material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.11 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as specified otherwise.

.12 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.

.14 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.2 Core neat circular holes in walls of existing manholes. Do not hammer or ship except as approved by Departmental Representative.

3.6 Pipe Surround

.1 Upon completion of pipe laying, and after Departmental Representative has inspected work in place, surround and cover pipes as shown on Contract Drawings.

.2 Hand place surround material in uniform layers not exceeding 150mm compacted thickness simultaneously on each side of pipe. Do not dump material within 1 m of pipe.

.3 Compact each layer from pipe invert to underside of backfill to minimum 95% Modified Proctor Density.

3.7 Backfill

.1 Place backfill in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling.

.2 Backfill requirements, including type of material and compaction requirements, as shown on Contract Drawings.

3.8 Cleaning and Flushing

.1 Before flushing and testing, ensure sewer system is completely finished and make arrangements with Departmental Representative for scheduling of testing.

.2 Water may be supplied from Department fire hydrants upon application for a Hydrant Use Permit.

.3 Obtain Department approval prior to discharging flushing water to sewers or drainage ditches.

.4 Comply Section 01 35 43 - Environmental Procedures in regard to discharge of

flushing water.

.5 Provide Departmental Representative with all required approvals prior to discharging flushing water.

.6 Remove foreign material from pipe and related appurtenances by flushing with water. Main to be flushed at water velocities as high as can be obtained from available water sources. Continue flushing at least until flow from most distant point has reached discharge point and until water discharged is clean and clear.

3.9 Leakage Testing - General

.1 Upon completion of cleaning and flushing of each section, carry out leakage testing as follows:
- .1 Video inspection.
- .2 Low pressure air test.
- .3 Rubber ball test, lamp test, mandrel test if directed by Departmental Representative.
- .4 Individual joint test, if directed by Departmental Representative.

.2 Perform testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.3 Perform tests in presence of Departmental Representative. Notify Departmental Representative 24 h in advance of proposed tests.

3.10 Video Inspection

.1 The Contractor shall video inspect completed sanitary sewers under 900 mm in diameter following completion of installation. The video inspection report shall be in the form specified by the Department Representative. Copies of the video tapes and written report shall be forwarded to the Department Representative when available.

.2 Should video inspection indicate apparent deficiencies; Departmental Representative may direct Contractor to perform additional testing as follows.

.3 Additional testing may include passing rubber ball, mandrel or test plug having a minimum dimension of 95% of diameter of sewer pipe completely through pipes and appurtenances. A light test may be performed in lieu of ball test at discretion of Departmental Representative.

3.11 Low Pressure Air Test

.1 Low pressure air test to include testing of sewer main and service connections in each section. Test manholes by low pressure air.

.2 Wet inside perimeter of concrete pipes in test section, then increase pressure in test section prior to conducting air tests. Then increase pressure in test section to 24 kPa above average groundwater pressure and observe rate of pressure drop.

.3 Maintain 25 kPa above average ground water pressure for at least 5.0 minutes before commencing internal air pressure test. Regulate air pressure to prevent pressure inside test section from exceeding 35 kPa above average ground water

pressure.

.4 Commence test period when pressure decreases to 24.0 kPa above average groundwater pressure and end when pressure decreases to 20.5 kPa above average groundwater pressure. Do not add air to test section during test period. If test period is less than:

2 minutes and 32 seconds for 100 mm pipe
3 minutes and 50 seconds for 150 mm pipe
5 minutes and 06 seconds for 200 mm pipe

sewer shall be deemed to have failed test. Retest upon completion of repairs to any leaks.

3.12 Rubber Ball/ Mandrel/ Lamp Test

.1 Pass rubber ball, mandrel or test plug having a minimum dimension of 95% of diameter of sewer pipe completely through pipes and appurtenances. A lamp test may be performed in lieu of ball test where specified by Departmental Representative.

3.13 Individual Joint Test

.1 Perform joint testing of installed pipe sections in accordance with ASTM C1103.

.2 Perform joint test as soon as possible following installation of pipes each side of joint if directed by Departmental Representative.

.3 Restrain pipe sections to prevent longitudinal movement due to pressure within joint void.

.4 Inflate bladders to provide firm contact on pipe interior on each side of joint, thereby isolating joint from rest of pipeline.

.5 Introduce between 30 to 70 kPa air pressure into joint.

.6 If test pressure drops by less than 7 kPa in approximately 5 seconds, joint is acceptable. This test is considered a "Go/No Go" test.

.7 If pipe joint fails test, reposition pipes, replace or repair and retest joint until test is acceptable.

3.14 Installation Standard

.1 Repair all deficiencies and visible leaks.

.2 Repair procedures and materials subject to approval of Departmental Representative.

.3 Departmental Representative reserves right to require Contractor to replace defective installations at Contractor's sole cost.

.4 Test Procedures, including video inspection, to be repeated and repairs made until satisfactory results are obtained.

.5 Acceptable Ponding:
- .1 Connections: 10mm maximum ponding over 3m length of pipeline.
- .2 Mainline PVC sewers:
  - .1 100mm to 200mm diameter: 10mm maximum ponding over 3m length of pipe.

3.15 Connections to Existing Mains

.1 Make connections to existing sanitary sewer systems unless shown otherwise on Contract Drawings. Notify Departmental Representative minimum 48 h in advance of scheduled connection.

.2 Make connection in presence of Departmental Representative. To prevent damage to existing utilities, excavate last 300 mm over utility by hand.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes .1 Materials and installation for storm sewer.

1.2 Related Sections
.1 Section 01 33 00 - Submittal Procedures.
.2 Section 03 30 00 - Cast-in-Place Concrete.
.3 Section 31 05 16 - Aggregate Materials.
.4 Section 31 23 33 - Excavating, Trenching and Backfilling.
.5 Section 33 05 13 - Manholes and Catch Basin Structures.

1.3 References
.1 American Society for Testing and Materials International, (ASTM)
.1 ASTM C 117, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
.2 ASTM C 136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
.3 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).
.4 ASTM D 3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
.5 ASTM F 794, Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

.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 CAN/CGSB-34.9, Asbestos-Cement Sewer Pipe.

.3 Canadian Standards Association (CSA International)
.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
.1 CAN/CSA-A5, Portland Cement.

.3 CSA B1800-[02], Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
.1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).
.2 CSA B182.4, Profile PVC Sewer Pipe and Fittings.
.3 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

1.4 Material Certification
.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Products having CSA certification to be used where readily available. Certification by Standards Council of Canada approved independent third body that products conform to CSA standards in acceptable in lieu of CSA certification.

.3 At least 2 weeks prior to commencing work, submit manufacturer's recent test data

and certification that materials to be incorporated into works are representative and meet requirements of this Section. Include manufacturer's drawings where pertinent.

1.5 Scheduling of Work

.1 Schedule Work to minimize interruptions to existing services. Maintain existing flow during construction.

.2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.

1.6 Waste Management and Disposal

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

.3 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative.

.4 Handle and dispose of hazardous materials in accordance with the Regional and Municipal regulations.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 Plastic Pipe, Mainline Smooth Profile and Perforated Drain Tile

.1 Polyvinyl chloride pipe up to 675mm in diameter, DR35. Pipe to have minimum pipe stiffness (F/Y) of 320 kPa at 5.0% deflection, ASTM D2412. Pipe to be manufactured to specification for pipe size ranges as follows:
.1 100mm dia. – 375mm dia. to ASTM D3034.
.2 450mm dia. – 1200mm dia. to ASTM F679.

.2 Pipes to be certified by Canadian Standards Association to standards for pipe size ranges below.
.1 100mm dia. – 1200mm dia. to CSA B182.2

.3 Joint: Pipe to include integral bell and spigot ends with stiffened wall section and formed groove for a rubber gasket; joints to conform to ASTM D3212, gaskets to ASTM F477.

.4 Normal pipe length joint to joint to be 4.0 m.

.5 Maximum installed deflection not to exceed 7.5% of the base inside diameter.

2.2 Service and Catchbasin Connections

.1 Storm sewer service connections to be 100mm minimum diameter; maximum diameter as specified on Contract Drawings.

.2 Storm sewer service connections 100mm and 150mm diameter to be PVC type DR28 sewer pipe.

.3 100mm and 150mm DR28 PVC storm service connection pipe to have a minimum pipe stiffness of 625kPa. Pipe to be manufactured to ASTM D3034 and certified by Canadian Standards Association to CSA B182.2

.4 Storm sewer service connections greater than 150mm diameter to be of size and material specified on Contract Drawings and to conform to applicable specifications for mainline pipe.

.5 Manufactured connections to non-reinforced or reinforced concrete mainline pipe to be made using sanded PVC pipe male end stub with integral bell by either:

.1 Stub grouted into neatly chipped hole in pipe wall by concrete pipe manufacturer. Grout to be Portland cement based grout.

.2 Stub epoxy resin cemented into neatly cored hole in pipe wall by concrete pipe manufacturer.

.6 Stub and bell orientation to be 45° to centerline of mainline 2pipe (wyes) for concrete pipe less than 1050mm diameter. Orientation may be 90° to centerline of mainline pipe (tees) for concrete pipe 1050mm diameter or larger. No section of service stubs to protrude past inside of concrete pipe wall.

.7 Manufactured wye connections to PVC mainline pipe to be made with extrusion moulded PVC or fabricated PVC fittings manufactured to ASTM D3034 and CSA B182.2

.8 Field installed tees and wyes:

.1 In-situ installation of tees and wyes into concrete or PVC mainline pipe shall be made with approved PVC swaddle installed to the manufacturers specifications into a neatly cored hole in the pipe wall.

.2 Connections to ribbed PVC pipe to be made with a preformed tee and wye fitting when connection is up to two sizes smaller than mainline pipe. For these pipes, in-situ installation of tees or wyes involving cutting across pipe ribs not permitted. For connections more than two sizes smaller than mainline pipe, an insertable tee for ribbed PVC pipe is permitted. When an insertable is used, hole cut into mainline pipe to cut as few ribs as possible.

.9 PVC service connection pipe and fitting joints: push-on type comprised of integral bell with single elastomeric gasket to ASTM D3212 and ASTM F477. Normal pipe laying length joint to joint to be 4.0m.

.10 Pipe and fitting joints for service connection pipe materials other than PVC type PSM sewer pipe to be as specified for applicable mainline pipe.

2.3 Concrete	.1	Concrete mixes and materials required for bedding cradles, encasement, and incidental uses: to Section 03 30 00 - Cast-in-Place Concrete.
	.2	Concrete to be minimum 20 MPa.
2.4 Pipe Bedding and Surround Material	.1	Granular material in accordance with Section 31 05 16 - Aggregate Materials.
	.2	Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
2.5 Backfill Material	.1	As shown on Contract Drawings.
	.2	In accordance with Section 31 05 16 - Aggregate Materials.

PART 3 - EXECUTION

3.1 Preparation	.1	Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Department Representative.
3.2 Trenching	.1	Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
	.2	Do not allow contents of sewer or sewer connection to flow into trench.
	.3	Trench alignment and depth as shown on Contract Drawings.
3.3 Granular Bedding	.1	Fill over-excavation below design elevation of bottom of specified bedding with granular bedding placed and compacted. Drain rock may be used for backfill of over-excavation only with Departmental Representative's approval.
	.2	Place granular bedding material across full width of trench bottom in uniform layers of 150mm compacted thickness to depth as shown on Contract Drawings.
	.3	Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
	.4	Shape transverse depressions as required to suit joints.
	.5	Compact each layer full width of bed to at least 95% Modified Proctor Density in compliance with ASTM D1557. (All following references to density imply in compliance with ASTM D1557).
3.4 Installation	.1	Handle pipe in accordance with manufacturer's recommendations. .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.2 Lay and join pipes to manufacturer's instructions and specifications except as noted otherwise herein. Concrete pipe as specified herein, PVC pipe to CSA B182.11.

.3 Horizontal tolerances: ± 50 mm from specified alignment
Vertical tolerances: ± 10 mm from specified grade. Reverse grade is not acceptable.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Pipes on curved alignments:

.1 Concrete pipe and ribbed profile PVC plastic pipe. Do not exceed permissible joint defection recommend by pipe manufacturer.

.2 Smooth PVC pipe: for 100 mm to 300 mm sizes conform to required curvature by bending pipe barrel. In no case shall radius of curvature to be less than 300 times outside diameter of pipe barrel. Joint defection not permitted for smooth profile PVC pipe.

.7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Cut pipes as required, as recommended by pipe manufacturer, without damaging pipe and leave smooth end at right angles to axis of pipe.

.10 Joints:

.1 Install gaskets as recommended by manufacturer.
.2 Support pipes with hand slings or crane to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
.3 Align pipes before joining.
.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
.6 Complete each joint before laying next length of pipe.
.7 Minimize joint deflection after joint has been made to avoid joint damage.
.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.11 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as specified otherwise.

.12 When any stoppage of Work occurs, restrain pipes as directed by Departmental

Representative, to prevent "creep" during down time.

.13 Plug lifting holes with approved prefabricated plugs, to pipe suppliers' recommendations for sealing methods.

.14 Make watertight connections to manholes.
- .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .2 Core neat circular holes in walls of existing manholes. Do not hammer or chip except as approved by Departmental Representative.

3.5 Pipe Surround

.1 Upon completion of pipe laying, and after Departmental Representative has inspected work in place, surround and cover pipes as shown on Contract Drawings.

.2 Hand place surround material in uniform layers of 150mm compacted thickness simultaneously on each side of pipe. Do not dump material within 1 m of pipe.

.3 Compact each layer from pipe invert to underside of backfill to minimum 95% Modified Proctor Density.

3.6 Connections to Existing Mainline Pipes

.1 Use prefabricated saddles or approved field connection materials and techniques to connect service pipes to existing mainline sewer pipe.

.2 For new connections to existing PVC mainline sewers, drill hole in mainline to exact dimension of new connection. Use saddle or insertable tee for connections more than two sizes smaller than mainline. Insertable tees may be used for all types of gravity mains provided insertable tee designed for applicable pipe thickness is used.

3.7 Backfill

.1 Place backfill to with Section 31 23 33 – Excavating, Trenching and Backfilling.

.2 Backfill requirements, including type of material and compaction requirements, as shown on Contract Drawings.

.3 Under paving and walks, compact backfill to at least 95% Modified Proctor Density.

3.8 Cleaning and Flushing

.1 Before flushing and testing, ensure sewer system is completely finished and make arrangements with Departmental Representative for scheduling of testing.

.2 Water may be supplied from Department fire hydrants upon application for a Hydrant Use Permit.

.3 Obtain Department approval prior to discharging flushing water to sewers or drainage ditches.

.4 Comply Section 01 35 43 - Environmental Procedures in regard to discharge of flushing water and provide Departmental Representative with all required approvals prior to discharging flushing water.

.6 Remove foreign material from pipe and related appurtenances by flushing with water. Main to be flushed at water velocities as high as can be obtained from

available water sources. Continue flushing at least until flow from most distant point has reached discharge point and until water discharged is clean and clear.

3.9 Video Inspection .1 The Contractor shall video inspect completed storm sewers under 900 mm in diameter following completion of installation. The video inspection report shall be in the form specified by the Departmental Representative. Copies of the video tapes and written report shall be forwarded to the Departmental Representative when available.

.2 Should video inspection indicate apparent deficiencies; Departmental Representative may direct Contractor to perform additional testing as follows.

.3 Additional testing may include passing rubber ball, mandrel or test plug having a minimum dimension of 95% of diameter of sewer pipe completely through pipes and appurtenances. A light test may be performed in lieu of ball test at discretion of Departmental Representative.

3.10 Installation Standard .1 Repair all deficiencies and visible leaks.

.2 Repair procedures and materials subject to approval of Departmental Representative.

.3 Departmental Representative reserves right to require Contractor to replace defective installations at Contractor's sole cost.

.4 Test Procedures, including video inspection, to be repeated and repairs made until satisfactory results are obtained.

.5 Acceptable Ponding:
- .1 Connections: 10mm maximum ponding over 3m length of pipeline.
- .2 Mainline PVC sewers:
  - .1 300mm diameter or less: 20mm maximum ponding over 3m length of pipe.
  - .2 Greater than 300mm diameter: 30mm ponding over 3m length of pipeline.
- .3 Mainline Concrete sewers:
  - .1 300mm diameter: 20mm maximum ponding over a 5m length of pipeline.
  - .2 Greater than 300mm diameter: 30mm maximum ponding over a 5m length of pipeline.

3.11 Connections to Existing Mains .1 Make connections to existing storm sewer systems unless shown otherwise on Contract Drawings. Notify Departmental Representative minimum 48 h in advance of scheduled connection.

.2 Make connection in presence of Departmental Representative. To prevent damage to existing utilities, excavate last 300 mm over utility by hand.

END OF SECTION

Appendix A
Geotechnical Memorandum

Reference No. VAN-00228940-A0
Pavement Upgrades – National Historic Site, Fort Langley, B.C.

275 – 3001 Wayburne Drive
Burnaby, BC V5G 4W3 Canada
T: 604.874.1245 • www.exp.com

Memorandum

Date:	November 2, 2015	**Reference No.:**	VAN-00228940-A0
To:	Tom Dunphy	**Total No. of Pages:**	6 + Attachments
Company:	Public Works &Government Services Canada		
Email:	tom.dunphy@pwgsc-tpsgc.gc.ca		
Prepared By/Email:	Don Sargent, P.Eng.	don.sargent@exp.com	
Project Name:	Pavement Upgrades – National Historic Site, Fort Langley, BC		
Subject:	Geotechnical Assessment		
Distribution/Email:	Don Chalmers, P.Eng., Parsons	don.chalmers@parsons.com	

1.0 INTRODUCTION

As requested, the following presents the site reconnaissance and subsurface exploration findings, and provides discussion and recommendations for the proposed pavement upgrade at the above-noted site.

The geotechnical services are provided by **exp** Services Inc. in accordance with the **exp** proposal dated September 18, 2015.

2.0 PROJECT DETAILS

The scope of work involves assessment of an existing parking area located on the western portion of the Visitor Centre parking facilities at the National Historic Site in Fort Langley, BC which was constructed in about 1965. The project is for the upgrade paving of an existing paved parking area, approximately 30m by 50m in plan dimension. It is understood that the asphalt pavement is failing under current traffic comprised of mostly cars and buses with a few small trucks.

3.0 SITE DESCRIPTION / RECORD INFORMATION

The site is located at the western most portion of the Visitor Centre parking facilities at the National Historic Site in Fort Langley, BC.

The parking lot improvement area is relatively flat and sloping down toward the north with a change in grade of approximately 3m across the site. The area is comprised of a central parking bay (bus parking bays) with travel lanes situated along the west and east sides of the bus parking bays and some car parking bays situated along the east side of the site. The traffic flows one way, from the northeast out to the southwest, but most of the traffic appears to use the western most travel lane. Buried utilities are also located within the paved area. The parking area is bordered by concrete curb and surrounded by grass cover with some trees.

4.0 SITE EXPLORATION AND RECONNAISSANCE

A geotechnical subsurface exploration was conducted on October 1, 2015, and consisted of:

- Four (4) asphalt cores done using a diamond circular saw; and,
- Four (4) hand dug auger holes taken to 1m depth thru the core hole.

The locations of the test holes are shown on Location Plan, Figure 1 in Appendix B. Soil descriptions at each location are included in the Summary of Hand Auger Logs in Appendix C.

At core locations, a description of asphalt thickness and base materials encountered are summarized as follows:

Location	Asphalt Thickness, mm	Base Materials
HA 15-01, East travel lane	35	75mm minus granular fill
HA 15-02, West travel lane	65	19mm crushed gravel
HA 15-03, West travel lane	65	19mm crushed gravel
HA 15-04, East travel lane	40	25mm crushed gravel

The geotechnical exploration was supervised by a technician from **exp**, who located the test holes, logged the subsurface conditions and gathered soil samples. Upon completion of the holes, they were backfilled with excavation spoils and sealed with an asphalt patch. The pavement cores and soil samples were returned to the **exp** laboratory for further visual classification, moisture content determination, and particle size analysis.

The test holes indicated subsurface conditions only at the locations of the holes. The precision of the subsurface conditions indicated depends on the methods used, frequency of sampling, and the uniformity of the subsurface conditions. The spacing of the test holes, frequency of sampling, and the method of exploration have been selected to meet the needs of the project within constraints of the budget and schedule for geotechnical exploration purposes.

Two (2) washed sieve analysis, per ASTM C 136 and C 117 were carried out; analysis reports are shown in Appendix D. Photos of asphalt cores taken in the laboratory are included in Appendix E.

Subsurface Conditions

The test holes generally encountered the following soil types:

Unit AP	**Asphalt**	**Surfacing 35mm to 65mm thick**
Unit F1	**FILL**	**SAND AND GRAVEL, crushed**
		- Compact, trace silt - 0.05 to 0.07m thick
Unit F2	**FILL**	**SAND AND GRAVEL**
		- Brown or grey, trace silt, and some crushed material - compact - 0.1 to 0.3m thick
Unit A	**Silty SAND**	
		- Brown, compact - moisture content: 12 to 31% - encountered at 0.1m to 0.3m depth - Sieve Test No. 1 and No. 2 (Appendix D)
Unit B	**Silty SAND to SAND**	
		- Lt. brown, compact - moisture content: 4 to 11% - encountered at 0.4m to 0.9m depth

The Unit F1 (SAND AND GRAVEL), representing the gravel base was encountered in three of four testholes. The Unit F2 (SAND AND GRAVEL) contained some crushed and rounded particles.

The sand and gravel fill was underlain by Unit A (Silty SAND) representing natural soils.

No groundwater seepage was encountered at the time of the subsurface exploration.

Site Reconnaissance

The existing pavement is in fair to poor condition, including the following:

- moderate to severe alligator cracking especially along the western most travel lane;
- longitudinal cracks and several trench patches;
- some uneven surfaces associated with asphalt patches;
- several construction joint cracks; and,
- some surface ravelling.

In general, most severe pavement distress appeared to be associated with the high traffic areas.

5.0 PRELIMINARY EVALUATION AND ANALYSIS

5.1 General

It is anticipated that proposed pavement areas will generally be underlain by granular trench fills and or Silty SAND subgrade soils.

5.2 Existing Pavement

The existing gravel surface was in generally poor condition. The testholes encountered 35mm to 65mm thick asphalt, with the greater thicknesses encountered at the two testholes located on western most travel lanes.

5.3 Pavement Design Criteria/Methodology

Pavement design evaluations were conducted in general accordance with the local practice. The local Ministry of Transportation & Infrastructure (Ministry) Pavement Structure Design Guidelines and some Municipalities guidelines were considered. Structural coefficients, drainage coefficients, and material properties for pavement construction materials have been considered. For design purposes, good drainage of the roadbed has been assumed.

For reference, the Ministry minimum pavement structure (T-01/15) for Type "C" Low Volume & Subdivision roads is as follows:

Type "C" Road (less than 100,000 ESAL's)

- 50 to 75mm of Asphalt Pavement
- 225mm of Well-Graded Base
- 300mm of Select Granular Sub-Base (over silt subgrades)

A project-specific pavement design has been developed. Project specific aspects include frequent car and bus use and an anticipated infrequent truck use. However, a number of other considerations affect pavement performance including:

- slow moving, and parked buses and trucks; and,
- site-specific subgrade conditions.

The pavement design has been based on experience combined with the anticipated car and bus use.

5.4 Subgrade Evaluations

Subgrade would typically consist of granular embankment fill or compact Silty SAND soil. Note that the silty Sand subgrade may be prone to frost heaves and weak conditions during spring thaw. In consideration of these subgrade conditions, our past experience on other similar projects and empirical correlations, we have considered representative subgrade parameters for pavement design purposes.

5.5 Existing Materials

The test holes encountered thin asphalt and granular fill layers overlying compact Silty SAND.

Based on the soils encountered in the test holes, it is judged that the on-site granular soils may generally be unsuitable for re-use as Select Granular Subbase because it would be impractical to salvage the thin granular layers.

5.6 Source Materials

It is understood that road surfacing materials would be available as follows:

- Granular fill from a pit located in the vicinity of the site.
- Hot mix asphaltic concrete from local supplier.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

The exploration test holes generally encountered thin asphalt and sand & gravel fill layers overlying compact Silty SAND. No groundwater seepage was encountered.

It is recommended that the existing asphalt surfacing should be removed and a new pavement should be placed for the proposed pavement upgrade.

The following outlines discussions and geotechnical recommendations.

6.2 Stripping

Stripping should be done for the new pavement, to remove any existing asphalt materials, water-softened soils and any unsuitable materials. If the exposed subgrade differs significantly from that encountered in the test pits, the Geotechnical Engineer should be given an opportunity to review the conditions in the field.

6.3 Roadway Excavation and Drainage

It is estimated that it would be practical to use conventional excavation equipment to excavate soils encountered in test holes at the site. Based upon the test hole results, it is considered that excavations could be kept free of standing water using conventional pumping sumps to facilitate excavation, where required.

It is anticipated that granular surfacing materials would be placed on stable subgrades after unsuitable materials have been stripped and removed.

6.4 Pavement Design

The new design pavement section may be taken as follows:

Table 6.4.1 – Pavement Structure

Assumed Subgrade	Pavement Structure		Equivalent Pavement
	Material Type	Thickness	Thickness
Granular fill or Compact Silty Sand	Asphalt Pavement	75mm	75mm
	19mm Crushed Base	225mm	400mm
	Select Granular Sub-base	300mm	-
	Total:	600mm	475mm

The standard pavement structure has a greater thickness than an equivalent structure comprised of asphalt over base gravels, however, use of one granular material may have some cost benefits over use of two materials.

It is recommended that the asphalt paving be constructed in accordance with current Master Municipal Construction Documents (MMCD). The base and subbase materials should conform to MMCD specifications and should be compacted to at least 95% of their Modified Proctor Maximum Dry Density (ASTM D-1557). It is recommended that the hot mix asphalt be placed in a single lift (75mm thick) and the asphalt mixture should comply with 19mm Class 1 Medium Mix.

6.5 Overlay on Existing Pavement

It is considered that a conventional overlay placed on the existing asphalt pavement may be impractical to construct and an overlay would reflect existing pavement distress soon after construction. Therefore, overlay is not recommended.

7.0 CLOSURE

Please note that this memorandum was prepared for the exclusive use of **exp's Client**, Public Works and Government Services Canada, and their designated consultants and agents. The attached Interpretation & Use of Study and Report (Appendix A) forms part of this memorandum, and it should be included with copies of the memorandum.

We trust that this report satisfies your present requirements. Should you have any questions regarding any aspect of the above-noted, please call the undersigned.

Submitted by:

exp Services Inc.

Don Sargent, P.Eng.
Senior Engineer

Reviewed by:

James Jin, P.Eng.
Geotechnical Engineer

Attachments: Appendix A – Interpretation & Use of Study and Report
Appendix B – Figures (Location Plan, Figure 1)
Appendix C – Summary of Hand Auger Logs (HA15-01 to HA15-04)
Appendix D – Laboratory Tests (Sieve Analysis Reports No. 1 & 2)
Appendix E – Asphalt Core Photos

L:\2015 (Starting at 0223820-A0)\0228940-A0 DWS Pavement Rehabilitation - Three Sites, Fraser Valley BC\60 Project Execution\62 Design\62.2 Reports\exp ME 2015 11 02 Geo Assessment Ft Langley.docx

Appendix A

Interpretation & Use of Study and Report

INTERPRETATION & USE OF STUDY AND REPORT

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering consulting practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental consulting unless specifically stated in the engineering report.

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 us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which 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. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF THE REPORT

The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are 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 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 OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorise only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

5. INTERPRETATION OF THE REPORT

a. Nature and Exactness of Descriptions: Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates 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 and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations, or building envelope descriptions, utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising 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 all persons making use of such documents or records should be aware of, and accept, this risk. 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. Where 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 us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.

c. To avoid misunderstandings, **exp** Services Inc. (**exp**) should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings, and specifications relative to engineering issues pertaining to consulting services provided by **exp**. Further, **exp** should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with **exp**'s recommendations. Any reduction from the level of services normally recommended will result in **exp** providing qualified opinions regarding adequacy of the work.

6.0 ALTERNATE REPORT FORMAT

When **exp** submits both electronic file and hard copies of reports, drawings and other documents and deliverables (**exp**'s instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by **exp** shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by **exp** shall be deemed to be the overall original for the Project.

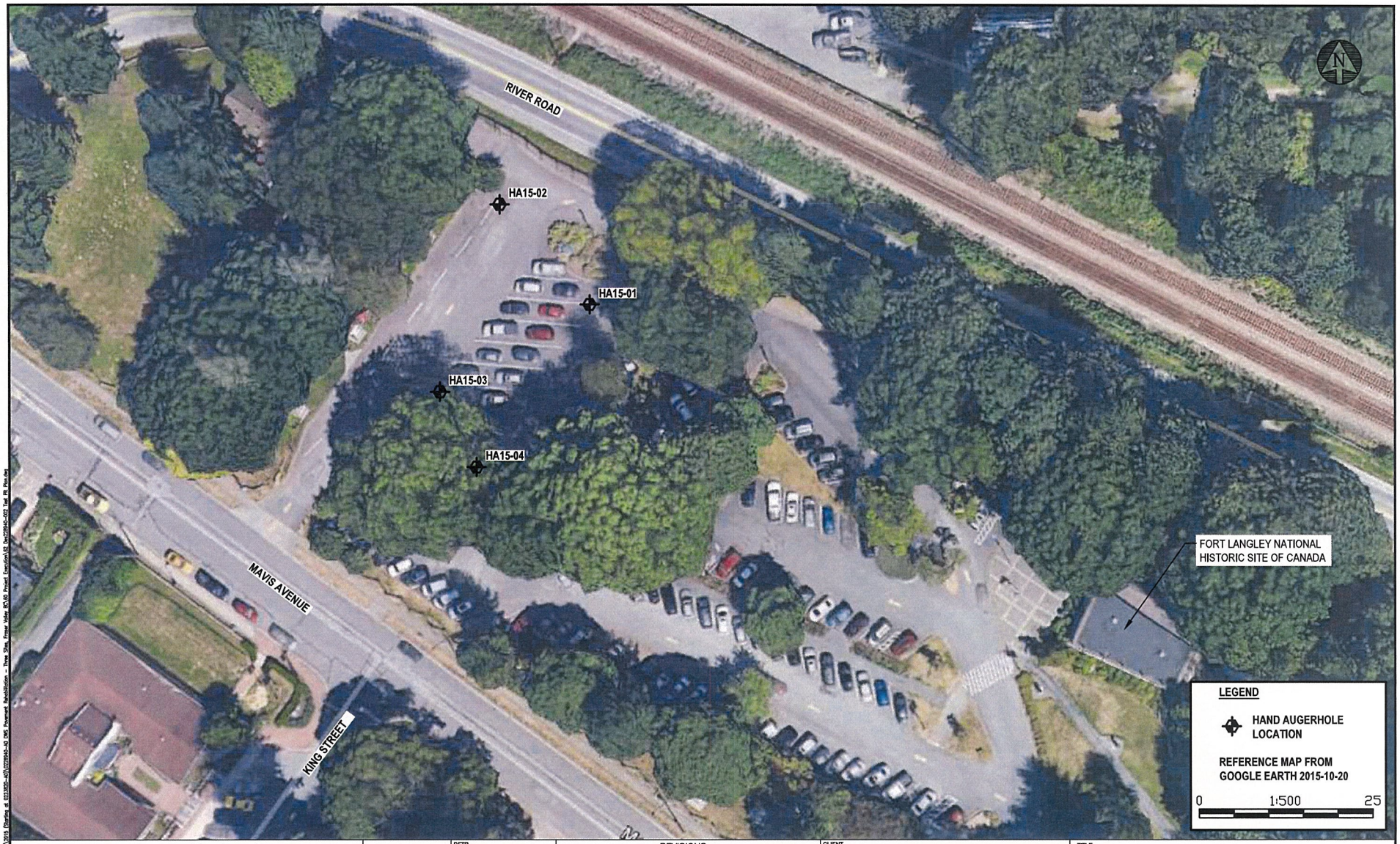
The Client agrees that both electronic file and hard copy versions of **exp**'s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except **exp**. The Client warrants that **exp**'s instruments of professional service will be used only and exactly as submitted by **exp**.

The Client recognizes and agrees that electronic files submitted by **exp** have been prepared and submitted using specific software and hardware systems. **Exp** makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

Appendix B

Figures

Location Plan, Figure 1



exp Services Inc.
275–3001 Wayburne Drive
Burnaby, British Columbia V5G 4W3
Telephone: 604–874–1245
Fax: 604–874–2358
exp.com

DFTR.	REVISIONS		
MG	No.	DESCRIPTION	DATE
DSGN.			
RK			
CHK.			
DWS			

CLIENT	Public Works and Government Services Canada
PROJECT	Pavement Rehabilitation Fort Langley National Historic Site, Mavis Avenue, BC
PROJECT NO.	VAN-00228940-A0

TITLE: Test Hole Location Plan

DATE	SCALE:	DWG NO.
2015-10-09	1:500	Figure 1

Appendix C

Summary of Hand Auger Logs
HA15-01 to HA15-04

Fort Langley
Summary of Hand Auger Logs

Material Type	HA15-01	HA15-02	HA15-03	HA15-04
Asphalt	0.035	0.065	0.065	0.04
Sand & Gravel Fill	-	0.065 to 0.12m	0.065 to 0.12m	0.04 to 0.09m
Gradations	-	19mm minus, some crushed	19mm minus, some crushed	25mm minus, Rounded stone
Consistency	-	Compact	Compact	Compact
Sand and Gravel Fill	0.035 to 0.3m	-	0.12 to 0.19m	0.09 to 0.26m
Gradations	75mm minus	-	25mm minus, some crushed	75mm minus
Consistency, Colour	Compact, Lt. Brown	-	Compact, Grey	Compact, Lt. Brown
Silty Sand	0.3 to 0.85m	0.12 to 1.0m	0.19 to 0.65m	0.26 to 0.4m
Moisture	S2 - 15.7%	S5 - 30.6%	S8 - 12.2%	S12 - 15.2%
Consistency, Colour	Compact, Brown	Compact, Brown	Compact, Brown	Compact, Brown
Silty Sand to Sand, some silt	0.85 to 1.0m	-	0.65 to 1.0m	0.4 to 1.0m
Moisture	S3 - 11.2%	-	S9 - 4.1%	S13 - 4.8%
Consistency, Colour	Compact, Lt. Brown	-	Compact, Lt. Brown	Compact, Lt. Brown
EOH	1.0m	1.0m	1.0m	1.0m
Groundwater Notes	dry or damp	damp	dry or damp	dry or damp

Notes:

1. Hand Auger locations are shown on testhole location plan.

Appendix D

Laboratory Tests

Sieve Analysis Reports

No. 1 and 2

exp Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3
604-874-1245

Kamloops Branch
250-372-5321

CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

TO exp - DON SARGENT

ATTN: DON SARGENT

PROJECT NO. 002-28940-3
CLIENT PUBLIC WORKS & GOV'T SERVICES
C.C. exp - DON SARGENT
exp - RENEE KORHONEN

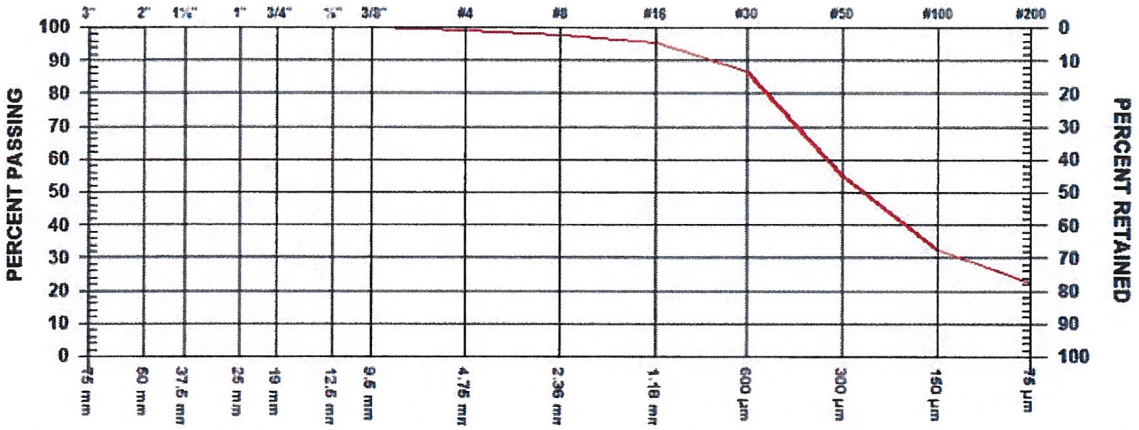
PROJECT PAVEMENT REHABILITATION - GEOTECHNICAL

CONTRACTOR

SIEVE TEST NO. 1 DATE RECEIVED Oct 01,2015 DATE TESTED Oct 09,2015 DATE SAMPLED Oct 01,2015

SUPPLIER EXISTING MATERIAL
SOURCE AUGER - SAMPLE 2 & 12
SPECIFICATION
MATERIAL TYPE SILTY SAND, TRACE GRAVEL

SAMPLED BY G. SAITO, AScT
TESTED BY G. SAITO, AScT
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm		
2"	50 mm		
1 1/2"	37.5 mm		
1"	25 mm		
3/4"	19 mm		
1/2"	12.5 mm		
3/8"	9.5 mm	100.0	

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
No. 4	4.75 mm	99.2	
No. 8	2.36 mm	97.8	
No. 16	1.18 mm	95.5	
No. 30	600 µm	86.6	
No. 50	300 µm	54.8	
No. 100	150 µm	32.5	
No. 200	75 µm	22.6	

MOISTURE CONTENT 15.5 %

COMMENTS
TEST METHOD: SIEVE, ASTM C136, C117; MOISTURE CONTENT, ASTM D2216.

 Oct 16,2015 exp Services Inc. KEVIN BOWYER, CTech PER. _____

exp Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3
604-874-1245

Kamloops Branch
250-372-5321

CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

TO exp - DON SARGENT

ATTN: DON SARGENT

PROJECT NO. 002-28940-3
CLIENT PUBLIC WORKS & GOV'T SERVICES
C.C. exp - DON SARGENT
exp - RENEE KORHONEN

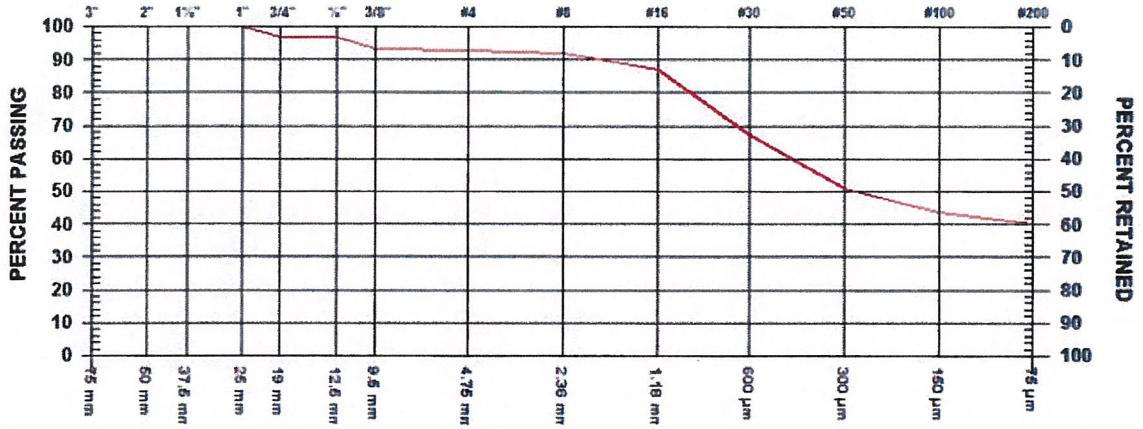
PROJECT PAVEMENT REHABILITATION - GEOTECHNICAL

CONTRACTOR

SIEVE TEST NO. 2 DATE RECEIVED Oct 01,2015 DATE TESTED Oct 09,2015 DATE SAMPLED Oct 01,2015

SUPPLIER EXISTING MATERIAL
SOURCE AUGER - SAMPLE 5 & 8
SPECIFICATION
MATERIAL TYPE SILT AND SAND, TRACE GRAVEL

SAMPLED BY G. SAITO, AScT
TESTED BY G. SAITO, AScT
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm		
2"	50 mm		
1 1/2"	37.5 mm		
1"	25 mm	100.0	
3/4"	19 mm	97.0	
1/2"	12.5 mm	97.0	
3/8"	9.5 mm	93.3	

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
No. 4	4.75 mm	92.8	
No. 8	2.36 mm	91.9	
No. 16	1.18 mm	87.0	
No. 30	600 µm	67.1	
No. 50	300 µm	50.9	
No. 100	150 µm	43.7	
No. 200	75 µm	40.2	

MOISTURE CONTENT 19.1 %

COMMENTS
TEST METHOD: SIEVE, ASTM C136, C117; MOISTURE CONTENT, ASTM D2216.

 Oct 16,2015 exp Services Inc. KEVIN BOWYER, CTech PER.

Appendix E

Asphalt Core Photos

Photo 1: HA 15-01 Asphalt Core, 35mm thick

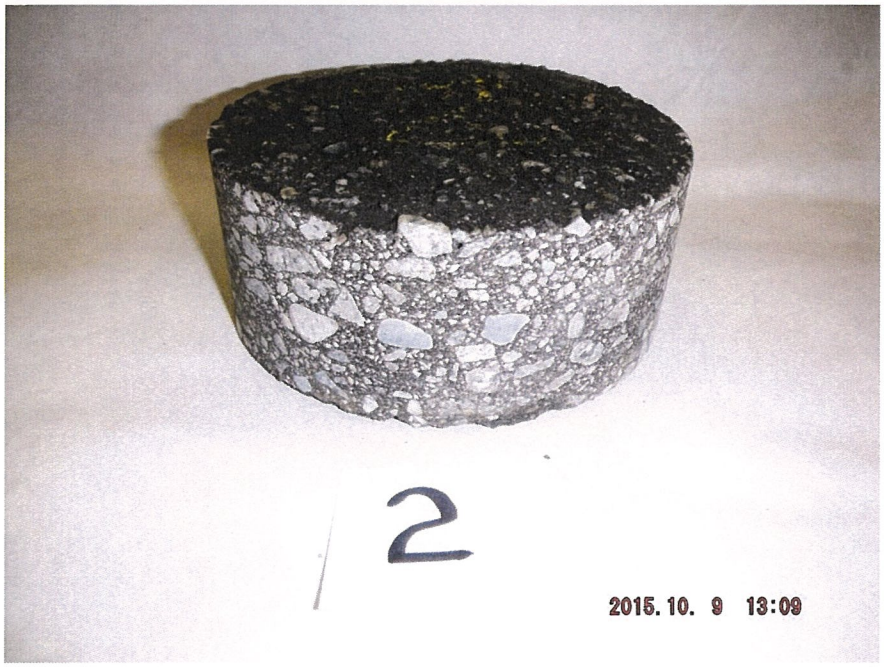


Photo 2: HA15-02 Asphalt Core, 65mm thick

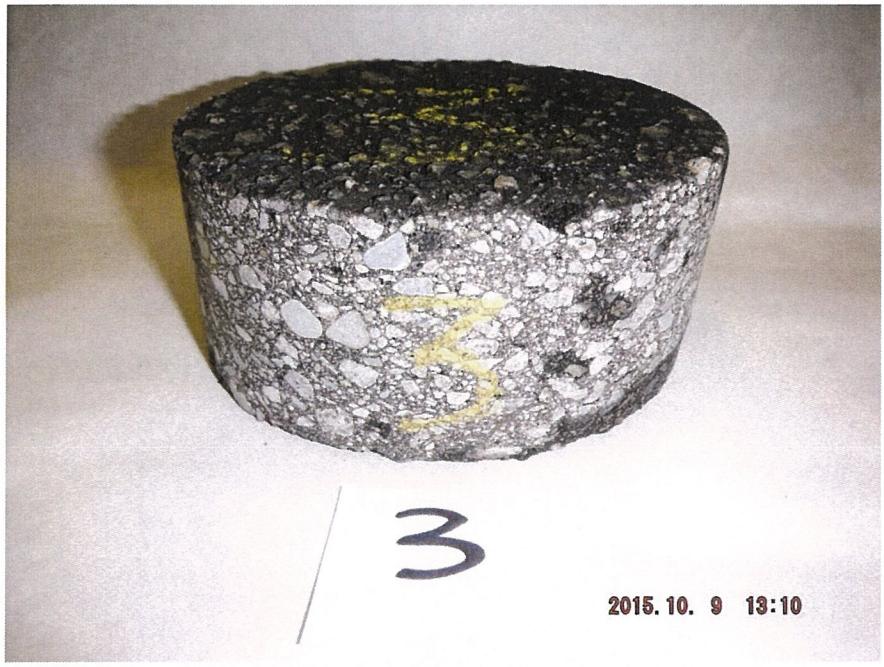


Photo 3: HA15-03 Asphalt Core, 65mm thick

Photo 4: HA15-04 Asphalt Core, 40mm thick

Appendix F
Shallow Soils Assessment Memorandum

Reference No. 10-10314
Pavement Upgrades – National Historic Site,
Fort Langley, B.C.

PARSONS

19890 - 92A Avenue • Langley, BC V1M 3A9 • (604) 513-1000 • Fax (604) 513-1040 • www.parsons.com

June 20, 2016 10-10314

Public Works and Government Services Canada
800 Burrard Street, 12th Floor
Vancouver, British Columbia
V6Z 2V8

Attention: Tom Dunphy, P.Eng

Dear Mr. Dunphy:

Re: Shallow Soils Assessment
Fort Langley Historic Site
23433 Mavis Avenue
Fort Langley, British Columbia

Parsons Inc. ("Parsons") is pleased to provide Public Works and Government Services Canada (PWGSC) with a summary of the testing of shallow soils situated beneath the pavement of the public parking area of the Fort Langley Historic Site, located at 23433 Mavis Avenue in Fort Langley, British Columbia (hereafter referred to as the 'site'). The objective of the program was to assess the soils beneath the asphalt that may require disposal during future repaving activities. The work was conducted as outlined in the scope of work provided to PWGSC dated March 9, 2016.

DESCRIPTION OF WORK AND OBJECTIVES

On May 11 and 12, 2016, Parsons personnel, with the assistance of a general contractor (Dogwood Petroleum), advanced 21 test pits through the asphalt in the public parking area of the Fort Langley Historic Site. The location of the area of investigation is provided on Drawing No. 1, and a detailed plan of the investigated area is provided on Drawing No. 2. Following a review of subsurface utilities, a jackhammer was utilized to break through the asphalt at each test pit location, and then a hand auger (dutch auger) was utilized to recover samples to a maximum depth of approximately 2.0 metres below ground surface (mbgs). Samples were recovered from each test pit at various depth intervals for soil classification, soil sample headspace measurement, and for possible laboratory analyses. Following sample collection at each location, the test pits were backfilled with the removed material, and completed at grade with cold patch asphalt.

Each soil sample was immediately split and one portion of the sample was sealed in a clean plastic bag for field screening, including visual observation for potential contamination (i.e. staining and/or odours) and measurement of the sample combustible headspace vapour concentration (soil vapour concentration). The remainder of the sample was promptly placed in containers supplied by the laboratory and stored in coolers with ice for analyses. Sample headspace vapour concentrations were measured using an organic vapour monitor (OVM) with methane elimination that was pre-calibrated prior to use.

All field procedures were conducted in accordance with generally accepted environmental engineering practice and British Columbia Ministry of Environment (BCMOE) guidelines for site characterization.

REGULATORY STANDARDS

The soil sampling results for the potential contaminants of concern (PCOCs) were compared to current standards in the BC Contaminated Sites Regulation (CSR) that are applicable to the relocation of soil from a site. These numerical standards are listed in Schedule 7 of the CSR and are used to assess whether soils can be relocated to either agricultural or non-agricultural land without a permit (soil relocation permit). Soils meeting these standards can be relocated to either agricultural or non-agricultural lands, depending on which standards the soils meet, without requiring a soil relocation permit.

Soils exceeding these Schedule 7 standards require a soil relocation permit prior to relocation and disposal at lands not permitted for contaminated soil disposal, or they can be relocated for disposal to a facility permitted to accept such soils.

FIELD OBSERVATIONS AND RESULTS

Test pit locations are indicated on Drawing No. 2. The highest soil sample headspace vapour concentration measured was 20 parts per million by volume (ppmv). No staining was observed in the soils, with the exception of possible black staining in TP-3 and TP-6. Soil samples were recovered from these two zones for chemical analyses.

Soil samples recovered from the test pits were submitted to Maxxam Analytics (Maxxam) in Burnaby, British Columbia, for the following analyses: benzene, toluene ethylbenzene and xylenes (collectively "BTEX"); light extractable petroleum hydrocarbons with the exception of naphthalene and phenanthrene ("LEPH"); heavy extractable petroleum hydrocarbons with the exception of benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene and pyrene ("HEPH"); polycyclic aromatic hydrocarbons (PAHs); methyl tertiary butyl ether (MTBE); and/or metals.

Soil chemical results are summarized in Table 1 through Table 3. As indicated, a sample recovered from TP-2 from approximately 0.5 mbgs contained chromium at a concentration exceeding the Schedule 7 standards for relocation to agricultural (but met the standards for non-agricultural lands). However, the chromium concentration did not exceed the allowable regional background concentration for the lower mainland (as indicated in BCMOE Protocol 4) therefore the chromium is considered to be within normal background levels for this region. A copy of the test pit logs is provided in Appendix A.

The remaining samples recovered did not contain analyzed parameters at concentrations exceeding CSR Schedule 7 standards.

The associated laboratory certificate is provided in Appendix B with a Quality Assurance/Quality Control (QA/QC) sheet detailing the data review. As indicated on the QA/QC sheet, the laboratory data reported for the reported activities were considered reliable.

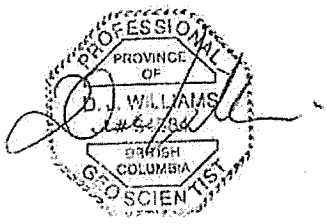
CONCLUSIONS

Based on the soil testing results, the shallows soils (those within the depth range of the investigation) beneath the public parking area at the site can be relocated to either agricultural or non-agricultural lands and no soil relocation permit would be required. This statement also includes the soils from TP-2, however the only stipulation is that they cannot be relocated to a site in the Kootenays, as the allowable regional background concentration for chromium in that region is 50 µg/g (and thus the sample concentration of 52.8 µg/g in the sample from TP-2 would exceed this limit).

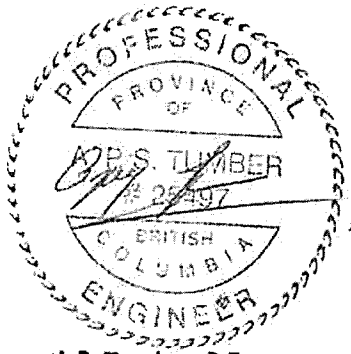
Should any questions arise regarding the information presented herein, please contact the undersigned.

Respectfully submitted,

PARSONS INC.



D.J. Williams, P.Geo.



2016-06-20

A.P. Tumber, P.Eng.

MJG/cer

LIMITATION OF LIABILITY, SCOPE OF REPORT AND THIRD PARTY RELIANCE

This report has been prepared and the work referred to in this report has been undertaken by Parsons for Public Works and Government Services Canada (PWGSC). It is intended for the sole and exclusive use of PWGSC, its affiliated companies and partners and their respective insurers, agents, employees and advisors (collectively, "PWGSC"). Any use, reliance on or decision made by any person other than PWGSC based on this report is the sole responsibility of such other person. PWGSC and Parsons make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

The investigations undertaken by Parsons with respect to this report and any conclusions or recommendations made in this report reflect Parsons' judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information examined at the time of preparation of this report. This report has been prepared for specific application to this site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by this investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by PWGSC, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Parsons. Nothing in this report is intended to constitute or provide a legal opinion.

Appendix G
Archeological Overview Assessment

Fort Langley National Historic Site
Parking Improvements,
Dated July 26, 2016

Archaeological Overview Assessment

Fort Langley NHS Parking Improvements

Prepared by Bill Perry

July 26, 2016

Purpose/Background

As Part of the Fort Langley NHS (See figure 1 for location) proposal to improve current parking facilities and accessibility, improvements will include: upgrading walking surfaces, access pathways, upgraded washrooms, and benches will be repaired or replaced, signage will be upgraded and parking areas will be upgraded, improved and repaved. For the purposes of this AOA, the parking area and project outlined in the Parsons plan of February 2016 will be considered for this assessment.

Observations

Extensive archaeology has been conducted at Fort Langley (figure 2) albeit mostly targeted within the known fort walls. Targeted test pitting has occurred outside the fort in the area of the VRC and east of the parking lot areas in response to various development projects over the years. Figure 3 shows the known fort outlines and archaeological features based on archaeological excavation and archival research. The project area is outlined in yellow hatching.

Two points:

1. a group of historic outbuildings are known to have existed adjacent to the project area to the north and west of the VRC building. In addition (as noted in figure 2), previous archaeological test pitting in this area and the area between the existing parking area and the fort walls have produced abundant archaeological material.
2. It is reasonable to suppose that any activities within the proposed parking area and the larger accessibility improvements program outlined in the RPA and development plans that exceeds the modern fill soil material layers, will encounter archaeological resources.

Requirements

Given the high potential for discovering additional archaeological resources, archaeological mitigation is required. As the majority of the project is located on previously disturbed lands, it is recommended that archaeological monitoring by a professional archaeologist with a First Nations observer (as per B.C. Professional archaeological regulations) be conducted on portions of the project that exceeds the depth of the modern fill soil zone, i.e. below the previous parking lot construction layers.

The Accidental finds clause (see below) must be adhered to during construction.

Terrestrial Archaeology, Parks Canada, has a Standing Offer for consultants qualified to conduct archaeological overviews and assessments. Due to our own capacity issues, we have not the ability to conduct the recommended archaeological monitoring ourselves.

Accidental finds

To be used in the unlikely event that cultural items are found when archaeologists or cultural resource managers are not present on site during construction activities.

There will almost certainly be cultural resources present in the project area that have not yet been discovered. If staff observe any cultural resources while working, they should stop work in the immediate area, and contact the project manager, or a Parks Canada archaeologist or cultural resource advisor (contacts listed below), to discuss any protective measures that might be needed. Significant resources that could be considered grounds for work stoppage include historic structural features, concentrations of artifacts and artifacts of the pre-contact (First Nations) and fur trade eras. In all cases, cultural managers must be made aware of the finds.

Rationale

I make the above recommendations based on these factors:

1. Past archaeological work done on the site and in the vicinity of the project area.
2. An assessment of the archaeological potential of the project area.
3. Not all archaeological mitigations will be 100 percent effective. Because of this, the Accidental finds protocol is included in this overview as an acknowledgment of this and a response to the high probability of encountering chance archaeological finds during any construction project.

References

Porter, J.E.P. and Peter D. Francis
2008
"Archaeological Resource Description and Analysis: Fort Langley National Historic Site of Canada". Manuscript on file, Cultural Resource Services, Western and Northern Service Centre, Parks Canada Agency, Calgary

Request for CRIA dated June 15, 2016

RPA entitled: "Fort Langley NHS Accessibility and Parking Area Improvements". Dated October 1, 2015.

GIS archaeological basemaps and associated databases held at Terrestrial Archaeology, Calgary.

Plan entitled: "Fort Langely Parking Lot Proposed Paving". Parsons, February 2016.

Attachments

Maps, Accidental Finds Protocol.

Contacts

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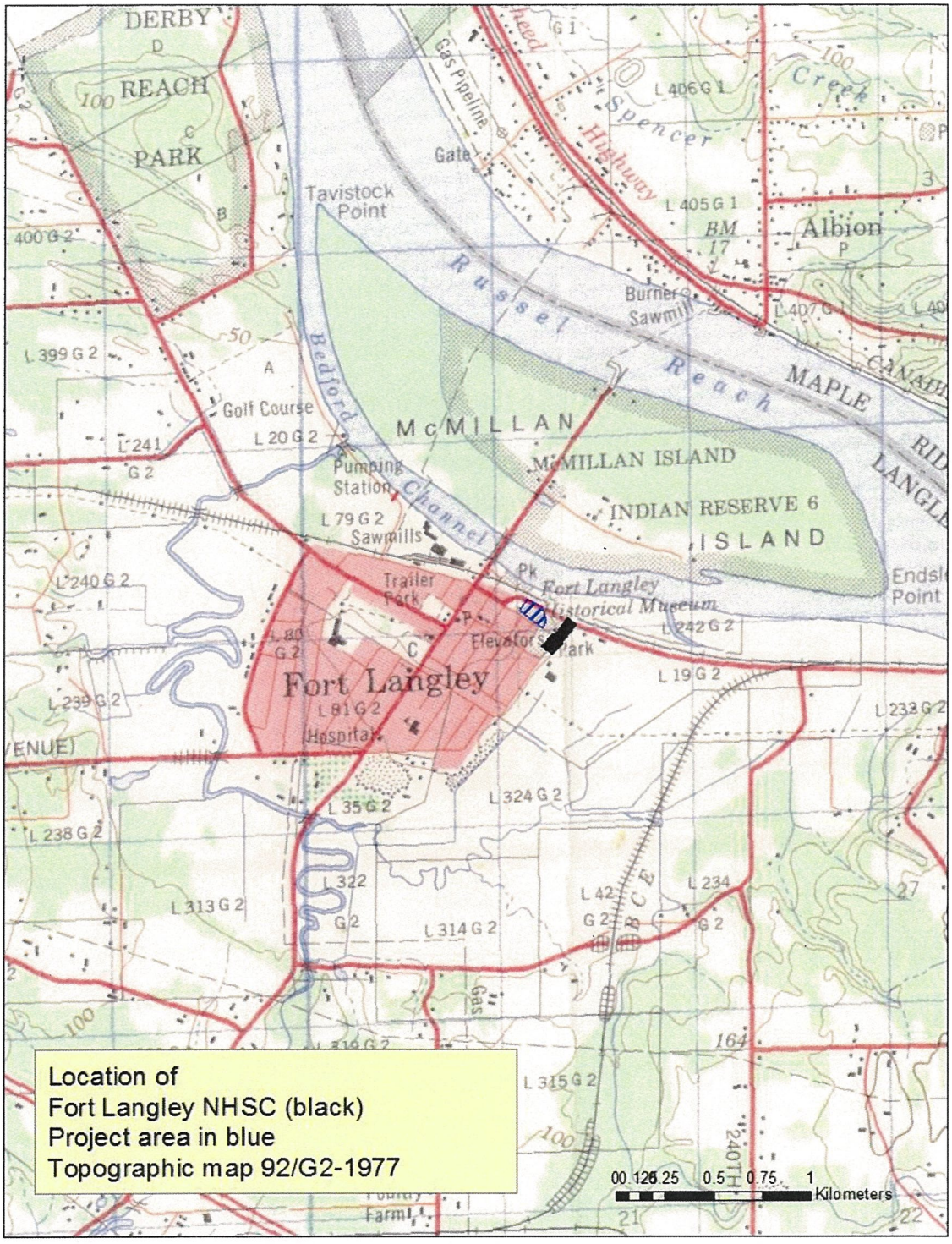

DERBY REACH PARK
Tavistock Point
Gas Pipeline
Gate
Spencer Highway
Creek
Albion
BM 17
Burner Sawmill
Russel Reach
MAPLE
CANAL
Bedford Channel
McMILLAN
McMILLAN ISLAND
INDIAN RESERVE 6
ISLAND
Golf Course
Pumping Station
Sawmills
Trailer Park
Fort Langley Historical Museum
Elevator
Park
Fort Langley
Hospital
Endsl Point
Farm
Location of
Fort Langley NHSC (black)
Project area in blue
Topographic map 92/G2-1977
0 0.125 0.25 0.5 0.75 1
Kilometers

Figure 1

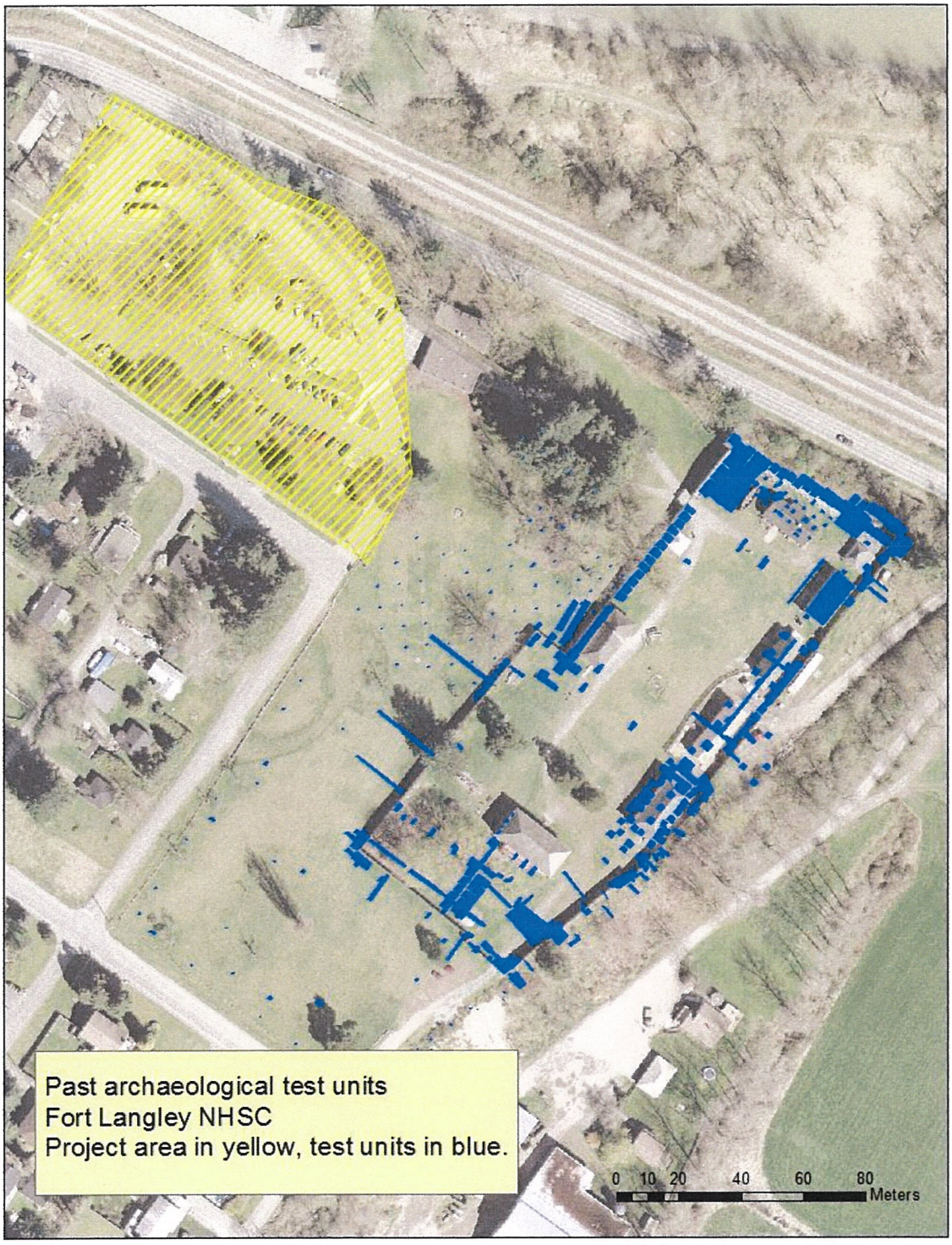

Past archaeological test units
Fort Langley NHSC
Project area in yellow, test units in blue.
0 10 20 40 60 80
Meters

Figure 2

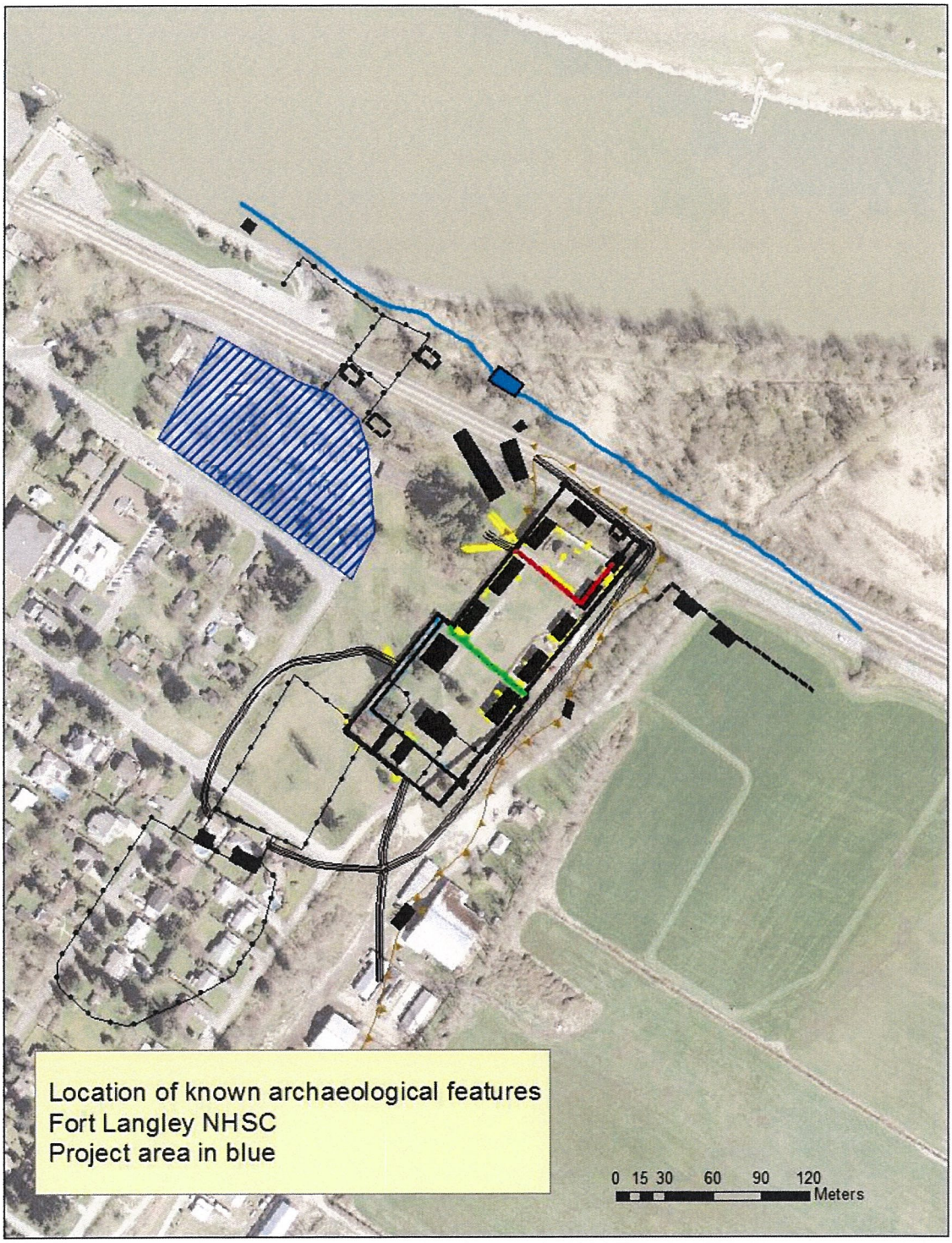

Location of known archaeological features
Fort Langley NHSC
Project area in blue
0 15 30 60 90 120
Meters

Figure 3

Appendix H
Best Management Practices, Roadways

Parks Canada National Best Management Practices, Roadway, Highway, Parkway, and Related Infrastructure
Dated July 23, 2015

Parks Canada National Best Management Practices

Roadway, Highway, Parkway and Related Infrastructure

Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure

Approved by

Original signed by Mike Wong

Mike Wong, Executive Director Natural Resource Conservation Branch

Original signed by Kalvin Mercer

Kalvin Mercer, Associate Vice-President Asset Management and Project Delivery

July 23, 2015

Date

1 Contents

1 Introduction

The Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure will allow an identified suite of project activities to be undertaken in such a manner that there will not be resulting significant adverse environmental effects.

The Best Management Practice (BMP) pathway is applied when there is a suite of routine, repetitive projects (e.g. paving) or activities (e.g.de-watering), with well understood and predictable effects. This fulfils Park's Canada's obligations under the *Canadian Environmental Assessment Act 2012* as a manager of federal land, see the Guide to the Parks Canada EIA Process. The BMP maximizes efficiency through creation of a pre-approved impact assessment for the defined suite of projects, to which standard mitigation and environmental management measures can be applied.

The impact assessment officer (IAO) will review a proposed project and advise the functional manager of the project if and how this BMP should be applied. The IAO's advice will be based on whether the project falls within the scope of the BMP, and whether application of the mitigation measures in the BMP will adequately address potential adverse effects of the project.

Project Managers are responsible to ensure all mitigation measures applicable to the project are added to the terms and conditions of any permits or contracts issued for the project.

The Impact Assessment Officers must ensure the project, EIA pathway applied and determination are recorded in the Parks Canada National Impact Environmental Assessment Tracking System.

2 Scope of Application

This BMP outlines the impact assessment of repetitive and routine projects on roadways, highways and parkways. If a project involves some or all of below activities, and the initial assessment of site and project indicate "the project is unlikely to result in significant adverse environmental effects" the BMP can be applied. Projects that this BMP would likely be applied to include:

1.1. The proposed maintenance or repair of an existing sidewalk, or parking lot.

1.2. The proposed maintenance or repair of an existing road, including pull-off areas that would be carried out on the existing right of way1.

Activities included in the scope of this BMP are:

1. Project Design
2. General Activities
   - Worksite Conditions/Staging/Laydown
   - Equipment operations
   - Fuel storage and refueling

[1] Highway Footprint or Right of Way (ROW): The permanent physical intrusion of a highway or freeway, including the road surface, shoulders, side slopes, drainage ditches and/or storm drainage ponds (Transport Canada, 2008).

- Site Clean Up/Waste Disposal

3. Asphalt Production and Handling
    - Asphalt Plant Operation
    - Gravel Crushing and Washing
    - Oiling of Truck Boxes
    - Clean Up and Disposal of Waste Products
4. Concrete Handling
    - Operation, maintenance and inspection of Onsite Temporary Concrete Washout Facility
    - Removal of Temporary Concrete Washout Facilities
    - Onsite concrete management
5. Paving, Resurfacing and Grading
        - Grading
        - Paving and Resurfacing
        - Pavement Marking and Barrier and Guardrail Reinstatement
6. Barriers and Guardrails
    - Repair, replacement and upgrades of barriers and guardrails
7. Vegetation Removal
        - Vegetation Removal
        - Grubbing
        - Brushing
        - Disposal of Vegetation Debris
        - Integrated Pest Management
8. Excavation, Soil Stripping and Overburden Removal
        - Excavation
        - Soil Stripping
        - Topsoil Salvage
        - Excavated Material Storage
        - Excess Material and Waste (overburden removal)
9. Slope Stabilization, Drilling and Blasting
        - Slope stabilization-scaling, hydraulic hammers
        - Drilling and blasting for Slope Stabilization and Geotechnical Investigations
10. Soil and Vegetation Restoration
        - Topsoil Replacement

- Soil Amendments
- Seedbed Preparation
- Species Selection
- Seed Lot Selection
- Seed Mixture Composition
- Seeding
- Alternatives to Seeding
- Reclamation Standards
- Reclamation Plot Evaluation
- Time Limits

11. Drainage Structures
    - Drainage structures
    - Culverts
12. Bridge Maintenance
    - Bridge Cleaning
    - Bridge Repairs Using Treated Wood Products
    - Bridge and Structure Painting
13. Water Withdrawal and Dewatering
    - Water Withdrawal
    - Pump Screens
    - Dewatering

3 Exceptions

This BMP is not suitable for the following project activities as they would require supplemental assessment and/or mitigations:

- Work that may impact aquatic or terrestrial wildlife habitat connectivity, such as fences or culverts;
- Elongation of culverts; realigning water courses; dredging; or work below the high water mark of a fish bearing water body;
- Bridge projects needing work to occur below the High-Water Mark[2], with permanent; alteration to the water course, such as replacement of piers/abutments or permanent installation of structures on the bed of a water body;

[2] High-water Mark is the usual or average level to which a body of water rises at its highest point and remains for a sufficient time so as to leave a mark on the land. (Fisheries and Oceans, 2015). Upper Controlled Water Elevation (UCWE) is used as definition of High-water Mark in managed waterways.

- Greater than 10% increase in land use footprint (e.g. gravel pit expansion); and,
- Work which might adversely impact any potential or established Aboriginal and Treaty rights or traditional use[3].

If the project has the potential to have an adverse effect on the critical habitat of a species at risk (with endangered, threatened, or extirpated status) this BMP does NOT apply. The project will require a separate environmental impact analysis.

If the project has the potential for **residual** adverse effects on a listed species at risk (including effects to individuals and residence of the individuals) this BMP does NOT apply, the project will require a separate environmental impact analysis.

Note: If there is any uncertainty regarding potential adverse effects to species at risk, consult a member of the National Office Species Conservation team.

4 Approved geographic area of application

This BMP is intended for use in all Parks Canada administered protected heritage places with roadways, highways and parkways.

5 Components of the environment that may be affected

Potential effects from projects of this type are well understood and predictable. They include:

Water Resources:

- Adverse modifications to surface drainage patterns
- Reduced water quality due to increased erosion, sedimentation, transportation of debris and contamination (i.e. from leaks and accidental spills, etc.)

Soil/Land Resources:

- Change in slopes, landforms, and landscape
- Soil compaction and rutting
- Slope instability, due to increased soil exposure and improper excavation and storage
- Soil contamination

Air quality:

- Decreased ambient air quality (i.e. from dust, equipment emissions, etc.)
- Increased ambient noise levels
- Temporary increased levels of CO2 and other pollutants

[3] Parks Canada must engage in additional and separate consultations with Aboriginal groups if there is a possibility of a project adversely affecting established or potential Aboriginal or Treaty rights. This is required to fulfill federal government responsibilities in upholding the honour of the crown. If there is uncertainty regarding the need for Aboriginal consultation with respect to a project, refer the matter to Parks Canada Legal Services for advice. Guidance on consultation may be sought from the Aboriginal Affairs Secretariat and from the guidance document "A Handbook for Parks Canada Employees on Consultation with Aboriginal Peoples".

- Temporary increased localized temperatures from paving and equipment operation.

Flora and Fauna:

- Damage to and/or removal of vegetation in immediate or adjacent areas
- Introduction of non-native species populations, or expansion of existing populations
- Wildlife sensory disturbance causing displacement/preferred habitat avoidance
- Wildlife habituation/attraction to artificial food sources
- Impeded/altered wildlife movement
- Damage to nests/disruption of nesting animals
- Mortality from project activities

Cultural Resources:

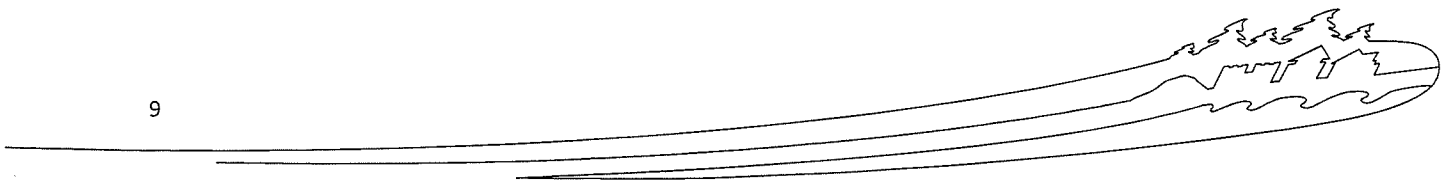
- Adverse effects on the heritage value or character-defining elements of a cultural resource
- Impacts to archaeological resources (known or potential)

6 Mitigation Measures

To use the document efficiently, keep the activity mitigation lists that apply to the project expanded and collapse the other activities by clicking on the section titles, print this as a pdf or paper document and include with the EIA determination record. This will reduce the overall size and scope of the mitigations to present to contractors and project managers.

Choose all that apply to project. Each title is hyperlinked to the related section.

Module	
1.	Project Design
2.	General Activities
3.	Asphalt Production and Handling
4.	Concrete Handling
5.	Paving, Resurfacing, Grading
6.	Barriers and Guardrails
7.	Vegetation Removal
8.	Excavations, Soil Stripping and Overburden Removal
9.	Slope Stabilization, Drilling and Blasting
10.	Soil and Vegetation Restoration
11.	Drainage Structures
12.	Bridge Maintenance
13.	Water Withdrawal and Dewatering



2. Project Design

When upgrades to infrastructure are planned opportunities to decrease the environmental impacts of long term operation should be considered in the engineering design. Some examples are: directing runoff into vegetated areas rather than directly into surface waters to decrease pollution in surface waters, increasing the span length of bridges during replacements to allow for terrestrial wildlife passage underneath and converting smaller culverts to larger culverts or clear span bridges to allow for better fish passage and less restricted flows.

3. General Activities Mitigations Module

Construction activities involve the use of laydown/staging areas, equipment operations, storage and handling of hazardous materials. Potential adverse effects include: destruction of vegetation, erosion and sedimentation, constriction for wildlife movements and introduction/spread of non-native vegetation.

6.1 Work Site Conditions/Staging/Laydown

3.1. All employees must attend a briefing with an Impact Assessment Officer (IAO) or Surveillance Officer (SO) before beginning work at the site review and explain the mitigations that are conditions of the project approvals.

3.2. Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible.

3.3. Avoid or terminate activities on site that attract or disturb wildlife. Vacate the area and stay away from the immediate location if wildlife display aggressive behaviour or persistent intrusion.

3.4. Control materials that might attract wildlife (e.g. petroleum products, human food and garbage).

3.5. Notify the SO immediately about dens, litters, nests, carcasses (road kills), wildlife activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported to SO within 24 hours.

3.6. Delineate the work zone; clearly mark the limits to active construction and the access and egress locations.

3.7. When work involves the disturbance of soils or the use of erodible materials (e.g. sands, topsoil), prevent the transport of sediment by the installing of appropriate erosion and sediment control.

3.8. An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken in proximity to watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger. The ponds shall also be designed to handle 1:5 year storm events, with overflow spill capacity for 1:10 year storm events and emergency spillway capacity for 1:100 year storm events. All components require regular maintenance to ensure effectiveness.

6.2 Equipment Operations

3.9. Equipment movements and workers' private vehicles shall be restricted to the 'footprint' of the construction area.

3.10. Ensure machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, noxious weeds and soils from off-site.

3.11. Operate machinery on land above the high water mark, on ice, or in another manner that minimizes disturbance to the banks and bed of any water body.

3.12. Limit machinery crossing (fording) a stream or watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure in compliance with the *Fisheries Act.*

3.13. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.

3.14. Use temporary crossing structures or other practices to cross streams or water bodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds.

6.3 Fuel Storage and Refueling/Emergency Plans

3.15. A Spill Response Plan will be prepared and detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products in accordance with all applicable federal and provincial legislation. The Plan shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement and sand blasting agents.

3.16. Spill kits shall be provided at re-fuelling, lubrication, and repair locations that are capable of dealing with 110% of the largest potential spill and shall be maintained in good working order. Site staff shall be informed of the location of the spill response kit(s) and be trained in its use.

3.17. If potentially hazardous materials (e.g. cement-based products, sealants or paints) are used on site ensure raw material, mixed compounds and wash water are not released to any watercourse or soils. Measures such as collection/drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks can prevent spills into the environment.

3.18. Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways.

3.19. Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The SO shall be notified immediately of any spill. In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up.

3.20. The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the proponent. The site will be inspected to ensure completion to the expected standard and to the satisfaction of Parks Canada.

6.4 Site Clean Up/Waste Disposal

3.21. Clean tools and equipment off-site to prevent the release of wash water that may contain deleterious substances.

3.22. Where possible, sweep up loose material or debris. Any material thought to pose a risk of contamination to soils, surface water or groundwater should be disposed of appropriately off-site.

3.23. Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in Parks Canada protected heritage places. These wastes

shall be contained and removed in a timely and approved manner and disposed at an appropriate waste landfill site located outside the Parks Canada protected heritage place. Construction waste storage containers, shall be emptied when 90% full. Waste containers will have lids, be wildlife proof if there attractants and waste loads shall be covered while being transported.

3.24. Sanitary facilities, such as a portable container toilet, shall be provided and maintained in a clean condition.

4. Asphalt Production and Handling Mitigations Module

Asphalt is a common building material for transportation infrastructure. Its production requires the use of gravel, water, and petroleum products, and associated project activities include transportation, storage and handling of these materials. Installation of asphalt plants is common within the larger parks where gravel extraction is undertaken.

6.5 Timing of Works

4.1. Asphalt works are preferably undertaken during periods of dry weather as this allows easier control of contaminated runoff and sediment.

4.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

6.6 Operation of Asphalt Plants

4.3. Asphalt plant operation must comply with all environmental pollution control regulations, including provincial regulations, and the plant operational plan.

4.4. Spoil piles and stock piles will be at least 30 meters from the edge of any water body.

4.5. There must be enough room between the stockpiles and the asphalt plant for a loader in the event of a spill at the asphalt plant.

4.6. A containment berm with an associated liner made of occlusive material (e.g. plastic of a thickness approved by the SO) and covered with absorbent sand or clay shall be installed under the asphalt storage tank to ensure containment of 110% of the tank's capacity.

4.7. The proponent shall be responsible for the purchase and safe delivery/storage/handling of asphalt cement and emulsions to the asphalt plant site.

4.8. Excess hot mix or reject new asphalt shall be temporarily in stored in the containment area sufficient to prevent runoff of petroleum into soils or surface waters as directed by the SO, and removed from the Parks Canada protected heritage place, prior to project completion.

4.9. Every effort will be made to recycle waste asphalt, either as a base course, or by recycling waste asphalt through the asphalt plant according to engineering specifications.Old cured ground asphalt material shall be removed, recycled, or stored for future recycling at an approved operational gravel pit or asphalt plant site. Stockpiles must be further than 30 metres from any surface waters.

4.10. Remaining stockpiles will be removed or incorporated into reclamation plans for the gravel pits or asphalt plant sites.

4.11. Asphalt to be removed must be sampled and analyzed to determine possible lead contamination.

Contaminated asphalt will be transported to an approved waste disposal facility. A receipt of delivery is to be provided to the SO.

4.12. Proponent should protect containment/catchment areas and drip trays at the asphalt plant from rainfall since, if contaminated, all of the collected water will require disposal of at an approved disposal facility at the expense of the Proponent.

4.13. Dyking and ponding will be required to control the rate and quality of runoff from the plant site.

4.14. Ensure that the water in the settling ponds remains clean of petroleum products. Any contaminated water will require disposal at an approved disposal facility at the expense of the Proponent.

6.7 Gravel Crushing and Washing

4.15. Where possible within engineering constraints, asphalt materials should be recycled to reduce the need for new gravel.

4.16. Gravel will be obtained from an approved operational borrow pit only. For gravel obtained from a borrow pit within a protected heritage place or borrow pit, gravel extraction within the footprint of the disturbed area of the approved operational borrow pit is permitted.

4.17. Gravel will not be crushed within 30 meters of any water body.

4.18. If water for cleaning is extracted from a watercourse, refer to water withdrawal section of this BMP.

4.19. If gravel requires washing, the water used will not be returned directly to any watercourse.

4.20. Water free from chemical contaminants will be discharged into ground where further erosion and runoff into surface water is prevented. Discharging into well vegetated ground surface, at a rate which prevents erosion can often provide increased absorption and reduction of sediment load.

4.21. Contaminated water must be treated to meet CCME guidelines or transported outside of the Parks Canada protected heritage place for disposal at an approved facility.

4.22. For waste removed from the park a detailed receipt of delivery to an approved facility will be provided to the SO.

6.8 Oiling of Truck Boxes

Trucks for hauling asphalt mixture shall have tight, clean, smooth metal beds that have been sprayed with a minimum amount of thin fuel oil to prevent the mixture from adhering and causing waste asphalt.

4.23. Truck boxes may be oiled only when absolutely necessary.

4.24. Oiling will take place in a bermed area, consisting of a plastic underlay with 15 centimetres overlay of clean gravel. Oil contaminated gravel will be hand collected (so as to prevent tearing of the plastic) from the bermed area daily, and put through the asphalt plant.

4.25. Vehicle covers shall be securely fastened.

6.9 Air Quality Mitigations

4.26. Asphalt plants should be 500 meters from buildings with human habitation.

4.27. Emissions from the asphalt plant and paving project equipment will comply with End Product Specifications (EPS) emission control standards and other provincial emissions regulations. Stack test results provided to the ESO by the operator or surveillance contractor may be required when the asphalt plant is at full capacity to ensure the plant is operating within the required standards. If the plant is not

operating within the appropriate levels, production will cease until the requirements are met.

4.28. Sludge removed from the clarifier that is free of chemical contamination will be contained to prevent fine dust particles from becoming airborne during windy periods.

4.29. Unannounced stack tests will be conducted throughout the project. If the plant does not meet requirements, operation will cease until the requirements can be met.

6.10 Disposal and Clean Up of Other Waste Products

4.30. To ensure regular clean-up of waste asphalt and petroleum spills, a defined clean up schedule will be established during the preconstruction meeting.

4.31. Leaks will be collected in drip-trays, the collected material will either be removed from the park, or recycled back through the Asphalt Plant. For any material removed outside the park to an approved facility, a detailed receipt will be provided to the ESO.

4.32. Used oil, filters, grease cartridges, oil cans and other waste products of plant servicing will be collected and disposed of at the nearest industrial waste facility.

5. Concrete Handling Mitigations Module

Concrete is a common construction material used in transportation infrastructure. Its use ensures longevity of the infrastructure and safety for public use. One litre of concrete wash water or leachate in 1000L of water will kill fish. Cement-based products including grouts and concrete are lethal to fish and many other aquatic organisms. Raw product or leachate entering a watercourse will alter water chemistry, making it more basic or alkaline.

6.11 Onsite Temporary Concrete Washout Facility

5.1. Temporary concrete washout facilities shall be located a minimum of 30m from storm drain inlets, open drainage facilities, and watercourses.

5.2. Temporary concrete washout facilities shall be temporary pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

5.3. Straw bales, wood stakes, and sandbag materials can be used to construct temporary containment walls or "barriers".

5.4. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.

5.5. The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

5.6. Perform washout of concrete mixer trucks in designated areas only.

5.7. Wash concrete from mixer truck chutes into approved concrete washout facility or collect in an impermeable bag for disposal.

5.8. Pump excess concrete in concrete pump bin back into concrete mixer truck.

5.9. Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.

5.10. Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per federal and provincial regulations.

6.12 Maintenance and Inspection of Temporary Concrete Washout Facilities

5.11. Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities.

5.12. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.

5.13. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

5.14. Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).

5.15. Onsite concrete waste storage and disposal procedures should be monitored at least weekly or as directed by the ESO.

6.13 Removal of Temporary Concrete Washout Facilities

5.16. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

6.14 Onsite Concrete Management

5.17. Rolling concrete mixers with surplus concrete in amounts less than one cubic metre of wet concrete may waste this concrete in the grade right-of-way as directed by the Parks Canada Representative in areas that drain well away from watercourses. Surplus amounts in excess of one cubic metre are to be returned to the batching yard.

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

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

5.20. Waste, solidified concrete from rolling concrete mixers in amounts less than 1 cubic meter and waste solidified concrete from construction pour shall be buried in the grade within 48 hours of the pour, subject to approval and direction from the Departmental Representative

6. Paving, Resurfacing, Grading Mitigations Module

Highway surface management activities are undertaken to ensure public safety on Parks Canada Agency highways by maintaining clean, level, and unbroken road surface conditions through activities such as pavement cleaning, patching, application of surface treatments, and pavement crack sealing. Grading is used to address drainage issues, vegetation encroachment, potholes and rough surfaces.

6.15 Timing of Works

6.1. Works are preferably undertaken during periods of dry weather (e.g., summer) as this allows easier control of contaminated runoff and sediment.

6.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

6.16 Grading

6.3. During grade construction conducted close to any watercourse, water body or wetland ensure materials are not pushed, fall or are eroded into the water or wetlands.

6.4. No grade building shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.

6.5. Materials shall be placed at storage sites or on the grade without spillage outside the work limits. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.

6.6. Retain a 30 metre vegetated buffer around water bodies or install runoff management structures.

6.7. If possible grade roads early in the spring before vegetation develops seed heads or late in season after vegetation has set seed and is dormant to minimize non-native vegetation propagation.

6.8. Ensure gravel or road bed material is free of weeds and comes from an approved operational gravel source free of other contaminates.

6.17 Paving and Resurfacing

6.9. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface waters.

6.10. Minimize application of seal coats in wet conditions. Attempt to apply only to dry surfaces and not prior to (within 24 hrs.) or during rainfall. If unforeseen rain arrives ensure runoff from recently seal coated surfaces are prevented from entering surface waters.

6.11. For asphalt handling and management see the Asphalt Mitigation Module of the BMP.

6.18 Pavement Marking and Barrier and Guardrail Reinstatement

6.12. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface water Pavement marking shall be undertaken pursuant to standard methods applied in National Parks for control of paint products, both in transport and handling. The Contractor shall present a description of methods to be employed for transporting and controlling paint and hazardous products, application of paint, cleaning of equipment, containment and disposal of waste paint and cleaning products, etc. the satisfaction of the Parks Canada Representative.

6.13. Where concrete barriers or guard rails are temporarily removed, for highway improvements, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

7. Barriers and Guardrails Mitigations Module

Repair, installation and upgrade of barriers and guardrails involves laydown/staging areas, equipment operations, minor excavation (e.g., for barrier post holes) and use of concrete. Potential adverse effects include destruction of vegetation and erosion and sedimentation.

6.19 Timing of Works

7.1. Where excavation is required, schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

7.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

6.20 Repairs, Replacement and Upgrades

7.3. An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken within 100m of watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger.

7.4. Where use of concrete is required for guardrail post holes, Concrete Handling Mitigations apply.

7.5. If vegetation removal is required for barrier or guardrail works, Vegetation Removal Mitigations apply.

7.6. Where concrete barriers or guardrails are temporarily removed, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

8. Vegetation Removal Mitigations Module

Roadside vegetation management activities include mowing, brushing, and landscape maintenance activities undertaken to maintain clear sight lines for highway users, control noxious weeds, facilitate effective drainage, and reduce possible fire hazards. Mature timber may need to be removed for improving road alignments, improving sight linesor replacing or repairing associated infrastructure. Grubbing (stump and root removal) may be required to prepare the ground surface for other activities.

6.21 Timing Windows

8.1. Vegetation clearing can negatively impact nesting birds and/or bats in spring and summer. Avoid all vegetation removal during this time. If vegetation removal is scheduled to occur within these times a qualified professional biologist/ecologist should further clarify the species presence and timing particular to the work site and any occupied bird nests, eggs, or nests of species protected under the Migratory Bird Convention Act (MBCA). See appendix on regulatory guidance for further detail on the MBCA and SARA.

8.2. If a nest is found during the pre-work surveys, the vegetated area will be left intact with a suitable sized buffer of shrubs/trees around it until the young have fledged and left the nest. Size of buffer species dependent, to be determined in consultation with professional biologist or park ecologist.

8.3. Grass mowing and trimming should not occur during peak spring or fall reptile/amphibian migrations and hatching. Consult a local biologist/ecologist for site and species specific timing windows.

6.22 Vegetation Removal Mitigations

8.4. Vegetation removal should be limited to the minimum Clear Zone Distance[4] dependent on type and size of road and maximum height needed to meet the road safety objectives.

8.5. Minimize full removal and retain vegetation when possible to reduce erosion.

8.6. Prior to the commencement of any vegetation removal, the worksite must be surveyed for species at risk. If species at risk are found, work must be stopped until site-specific mitigations to address potential adverse effects are developed.

8.7. Survey vegetation for non-native species, clear vegetation areas with non-native vegetation in spring and early summer to avoid further spread and development of the non-native seed bank.

8.8. Clearing activities shall be avoided during nesting seasons for birds, reptiles and amphibian species in the project area.

8.9. If wildlife is observed during work, if possible, give animals the opportunity to escape the work area to the surrounding forest or elsewhere to seek new shelter.

8.10. Avoid ground vegetation removal during dry, windy periods to prevent erosion of topsoil and reduction of air quality with dirt/dust.

8.11. Retain 30 metre vegetated buffer around water bodies, where disturbance is necessary and unavoidable restoration is required.

8.12. Debris will not be deposited in water bodies.

8.13. Ensure tree limbs/stumps are flush cut as close to the ground or stem as possible.

8.14. Logs and other salvage materials are to be conveyed to and placed at a storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.

8.15. During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport to a designated pit.

8.16. Where possible preserve identified wildlife trees by limbing or topping if they are not assessed as hazard trees.

6.23 Disposal of Vegetation Debris

8.17. All vegetation debris must be removed as soon as possible from the right-of-way, either by transporting off-site for disposal or piling and burning on-site.

8.18. All vegetation containing non-native species will be piled and burnt or bagged and removed off site to disposal facility.

8.19. Piles will be made where trees are felled, piles will be 1.2-1.8 (4 to 6 feet) in diameter and no more than 1.2 m (4 feet) high (approximately 1 to 3 trees per pile) or as instructed by local fire and vegetation specialists.

[4] A clear zone is an unobstructed, traversable roadside area designed to enable a driver to stop safely or regain control of a vehicle that has accidentally left the roadway. The selection and design of appropriate clear zone dimensions is project-specific and should be the responsibility of professionals trained in roadside design.

8.20. Piles are to be located so that they do not scorch surrounding live trees and measures must be in place to ensure that fires do not spread (i.e., conduct burning on snow or on mineral soil).

8.21. Piles will be left until fall for burning to allow for curing of green fuels.

8.22. Provincial regulations for air quality must be met.

8.23. Where fire fuel loading is not a concern vegetation debris of limited amounts will be dragged in the forest to mimic natural tree fall.

8.24. If removal or burning are not feasible a chipper may be used for less than 50 boles per hectare. Chip depth is to be a maximum of 5 cm (2 inches), spread over area no greater of 5m x 5m per hectare so as to not cover underlying vegetation, prevent new native seedlings from sprouting, and cause soil/seed bank sterilization. Spreading of chips may extend beyond these parameters with permission from Parks Canada.

8.25. To facilitate chipping of woody debris, all trees/shrubs/vines can be left temporarily along the road shoulders and laid facing the same direction.

8.26. In some cases, logs from newly cut trees may be set aside for use elsewhere as directed by local park site managers and the ESO.

8.27. Store removed vegetation on already disturbed areas to minimize disturbance area.

8.28. In appropriate areas re-establish native vegetation where it has been completely removed/damaged.

6.24 Integrated Pest Management

8.29. A Field Unit Integrated Pest Management Plan (IPMP) must be completed and approved prior to the use of herbicides to ensure the most effective and least harmful substances are properly used.

9. Excavations, Soil Stripping and Overburden Removal Mitigations Module

Construction projects often involve excavations. To successfully complete reclamation of disturbed areas, and protect areas from erosion proper soil handling and backfilling procedures must be followed. Post excavation and stripping soil and vegetation restoration mitigations should be applied. See section of this BMP for Soil and Vegetation Restoration.

6.25 Timing of Works

9.1. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

9.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

6.26 Excavation

9.3. Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation.

9.4. All sediment control measures must be in place before starting work in the vicinity of rivers, water bodies, watercourses, and wetlands.

9.5. Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.

9.6. Excavation plans must be compared to local archaeological resource inventories, if available. If no archaeological information is available for the work area, an Archaeological Overview Assessment (AOA) may be required to determine the archaeological potential of the work area. Based on the results from the AOA, an Archaeological Impact Assessment might be required. It would be time and cost efficient to refer the plan to Parks Canada's Terrestrial Archaeology section before conducting any excavation to determine the appropriate course of action.

9.7. If cultural resources (eg. archaeological resources) are discovered, immediately cease work, and alert SO.

9.8. Minimize changes to the ground surface that affects its infiltration and runoff characteristics and maintain/re-establish effective surface drainage on completion of the project

9.9. Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.

9.10. All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment.

6.27 Soil Stripping

9.11. Strip topsoil under dry conditions, whenever possible.

9.12. No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.

9.13. In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavourable for construction, heavy rain events, construction delays, etc.) erosion control of bared soils or excavated material stockpiles is required.

9.14. Stripping close to any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands.

9.15. Work within a 100 metre buffer from the high water mark of waterways or wetlands will require a site specific sediment and erosion control plan.

9.16. An erosion control plan is also needed to control dust generated from the construction site.

6.28 Topsoil Salvage

9.17. Salvage topsoil at all excavation sites for reclamation purposes.

9.18. Usually the upper 15 cm of soil, below the sod layer if present, is considered topsoil, where depths exceed 15cm salvage the entire depth of topsoil.

9.19. Remove stumps and woody debris from topsoil, wherever possible.

6.29 Excavated Material Storage

9.20. Allow space for separate storage of topsoil and spoil; where space is available separate stored topsoil from spoil by at least 1 m. Use appropriate material (e.g., geo-textile) to separate soil components where space is limited.

9.21. Topsoil may be stored on hardened surfaces, geo-textile material or directly on undisturbed vegetation.

If storage occurs on vegetation, material recovery by hand may be required.

9.22. Cover all stockpiled material with heavy-duty plastic or filter cloth to prevent erosion during precipitation events.

9.23. Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain.

9.24. Construct barricades to prevent losses on steep terrain (>18°, 3:1) and within 100m of watercourses.

6.30 Excess Materials and Waste (Overburden Removal)

9.25. Remove excess excavated material from site where it cannot be used for the final grading of the area. Site specific arrangements must be made for disposal locations and procedures of overburden.

9.26. Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO.

10. Slope Stabilization, Drilling and Blasting Mitigations Module

Where standard excavation is not sufficient, scaling, hydraulic hammers, drilling units or trim blasting are used to break up rock or soil for removal. Accumulations of debris in ditches reduce their effectiveness at trapping rock fall and reduce public safety. Ditches will be cleaned using a loader and back hoe. Guardrails and rock fences may be temporarily removed to permit this activity.

6.31 Timing of Works

10.1. Time any vegetation removal work should adhere to the Migratory Bird windows for the area.

10.2. Time work to reduce impact to mammals, amphibians and reptiles using rock faces during sensitive life stages such as birthing and rearing of young. This often occurs during the spring. Confirm timing windows with local wildlife ecologists.

10.3. Avoid ditch clearing during wet periods and wait until ditches are dry to reduce impacts to amphibians and reptiles and limit sedimentation.

6.32 Slope Stabilization-Scaling, Hydraulic Hammers

The use of hydraulic hammers attached to excavators is considered the ideal solution for rock disintegration. It avoids rock blasting where the parent rock is no longer rippable by the excavator's bucket but still has enough planes of weakness for economical operation and effective use of the hydraulic hammer. Scaling is the manual removal of loose material on rock slopes using pry bars, hydraulic press, brooms, shovels and power equipment operated by personnel using roped access to a rock face.

10.4. For vegetation clearing refer to the vegetation removal mitigation module of this BMP.

10.5. For slope-stabilization in soils, please refer to the Excavation section.

10.6. Survey the work site for cultural resources such as rock art (ex. pictographs, petroglyphs, etc. prior to the work commencing, establish site specific mitigations for their protection.

10.7. Measures shall be taken to control dust as much as possible during the removal and falling of rock materials down slope.

10.8. Placement of rip rap and backfill on shorelines shall be undertaken without contacting the watercourse,

wetted margins and must not be below the High Water Mark.

10.9. If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately- sized, clean rock is used, and rock is installed at a similar slope to maintain a uniform bank.

10.10. Direct concentrated surface water (runoff) away from cut and fill slopes.

10.11. Immediately stabilize banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through vegetation restoration with native species suitable for the site-refer to soil and vegetation restoration section of BMP.

6.33 Drilling and Blasting for Slope Stabilization and Geotechnical Investigations

Trim blasting is used for controlled blasts in which explosive charges are placed in predetermined pattern of holes drilled into the rock face and then detonated. Potentially unstable masses of rock can sometimes be stabilized using rock bolts and long steel rods drilled into the rock to bind it together. Drilling is a common method of investigation to obtain geotechnical reports required for engineering design.

6.34 Drilling

10.12. Debris from drilling will be contained (screened or settle out) so it will not cover the surrounding area or enter any water course. All debris will be removed, see section on overburden removal for further mitigations.

10.13. The cuttings from all drilling will be contained so they can be removed entirely from the site. If contaminated, the cuttings are to be disposed at an approved waste disposal facility.

10.14. Control of spoil and sediment loaded water is required on the drill site. Dyking will be required to retain the deposit on non-vegetated surfaces. If contaminated, the spoil pile must be disposed at an approved waste disposal facility.

10.15. During aquifer tests, the water must be piped so it does not erode any soil or any part of the ground. If the water from the tests is piped to a creek, stream, or river, the pipe is to be situated so that there is no erosion of the stream bank or bed. If any sand or similar material is discharged during the aquifer test, care must be taken that the sand does not cover any vegetation.

10.16. All test wells will be filled in after the testing is completed. The proponent will be responsible for rectifying any future problems associated with any of the wells or test wells.

6.35 Blasting

10.17. The Parks Canada Representative will identify a magazine location for explosives should a factory site or "ready-to-use" explosives storage site be required

10.18. The blasting supervisor will ensure no damage to infrastructure, people, surrounding vegetation or wildlife by mitigating risk of fly rock.

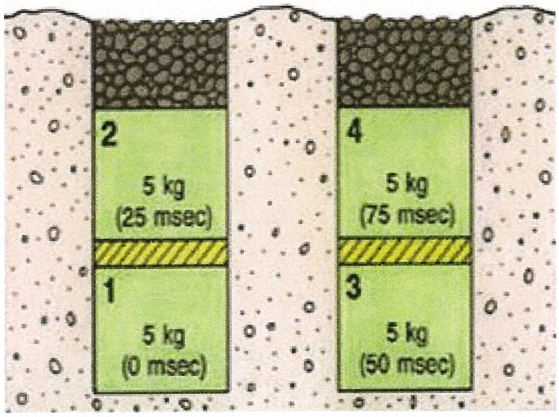
10.19. Avoid using explosives in or near water. Use of explosives in or near water produces shock waves that can damage a fish swim bladder and rupture internal organs. Blasting vibrations may also kill or damage fish eggs or larvae.

10.20. If explosives are required as part of a project (e.g., removal of structures such as piers, pilings, footings; removal of obstructions such as beaver dams; or preparation of a river or lake

bottom for installation of a structure such as a bridge or culvert), the potential for impacts to fish and fish habitat will be minimized by implementing the following measures:

- Time in water work requiring the use of explosives to prevent disruption of vulnerable fish life stages, including eggs and larvae, by adhering to appropriate fisheries **timing windows**.
- Isolate the work site to exclude fish from within the blast area by using bubble/air curtains (i.e., a column of bubbled water extending from the substrate to the water surface as generated by forcing large volumes of air through a perforated pipe/hose), cofferdams or aquadams.
- Remove any fish trapped within the isolated area and release unharmed beyond the blast area prior to initiating blasting.
- Minimize blast charge weights used and subdivide each charge into a series of smaller charges in blast holes (i.e. Decking) with a minimum 25 millisecond (1/1000 seconds) delay between charge detonations (see Figure 1).
- Back-fill blast holes (stemmed) with sand or gravel to grade or to streambed/water interface to confine the blast.
- Place blasting mats over top of holes to minimize scattering of blast debris around the area.
- Do not use ammonium nitrate based explosives in or near water due to the production of toxic by-products. Remove all blasting debris and other associated equipment/products from the blast area.

Figure 1: Sample Blasting Arrangement



Per Fig. 1: 20 kg total weight of charge; 25 msecs delay between charges and blast holes and decking of charges within holes. (Fisheries and Oceans Canada, 2015)

11. Soil and Vegetation Restoration Mitigations Module

Almost all projects activities included in this BMP will require some ecological restoration- *the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed*. The restoration plan can be a simple application of the following mitigations and can be at the site or both at the site and in concert with another site designated to offset the permanent impact of a project. For disturbance areas greater than a hectare a restoration plan is required. The restoration works can be often be considered projects in and of themselves. Soil and vegetation restoration must apply the principles of effective, efficient and engaging solutions.

6.36 Timing Windows

11.1. Develop restoration plan as part of the project scoping and specifications prior to project approvals.

11.2. Vegetation restoration is most effective if seeded in the fall, this allows for full scarification of the seed over the winter and adequate moisture available. Spring and early summer will also work, consider using seed that requires shorter scarification times for these applications. Transplants will do best in the spring and summer and will require adequate watering.

6.37 Topsoil Replacement

11.3. Implement restoration plan for the disturbed area immediately following completion of construction.

11.4. Replace topsoil to all areas immediately following fine grading.

11.5. Do not compact topsoil.

11.6. Where insufficient topsoil is available imported soil may be used as a last resort. Imported topsoil must be certified completely free of non-native seeds and compost developed from sewage treatment plants. Methods of improving vegetation succession using locally sourced, weed and contaminant free materials are preferred.

11.7. Slopes to be seeded should be no steeper than 2 horizontal to 1 vertical (2:1) and covered with a minimum of 5 cm (2 inch) of topsoil. Finish grading should always follow top soil placement.

11.8. Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or erosion control blanket is required.

11.9. Methods of bioengineering such as terracing, willow staking, live pole drain systems should be assessed as solutions where soils are steeper or remain unstable.

6.38 Soil Amendments

6.38.1 *Fertilizer Application*

11.10. Avoid use of fertilizer to limit non-native vegetation growth and allow for local species to use available nutrients.

11.11. If needed use locally sourced mycorrhizae compost teas to improve vegetative success.

6.38.2 *Topsoil substitute*

11.12. Apply an organic cellulose only amendment as a soil substitute if reclamation standards are not being met within the defined time frame.

11.13. Determine the type of organic amendment based on the site-specific requirements (e.g., peat moss, compost).

6.39 Seedbed Preparation

11.14. The seedbed will be scarified by hand or, with the approval of the SO, by machine on large areas (i.e., roadbeds) where it is accessible and appropriate.

11.15. The seedbed will be scarified if seeding takes place more than 7 days after final grading or if there has been a rainfall between final grading and the seeding date.

11.16. The cleats of a tracked vehicle or a harrow device will be used, where possible, to prepare an adequate seedbed with seedling safe-sites (microsites) substantially free of soil crusts.

11.17. Align cleat marks at right angles on slopes to trap seed and sediment and reduce erosion.

6.40 Species Selection

11.18. When selecting species and varieties:

- Use species of local native plant communities.
- Species viability in proposed environment and climatic conditions.
- Capability to effectively control erosion, where required.
- Adaptation to the variable site conditions of undulating topography.
- Consider palatability of some species to herbivores and avoid growing attractants in areas of increased risk to wildlife and visitors.
- Variable life expectancy to produce variable, delayed die-out of seeded species and replacement with indigenous native plants.

6.41 Seed Lot Selection

11.19. Select seed lots based on indigenous species variety and quality (guaranteed weed seed free content and highest purity and germination), consult with vegetation restoration specialist or fire/vegetation ecologist.

11.20. Reject any seed lots containing any seed of undesirable crop or weed species.

6.42 Seed Mixture Composition

11.21. The proportion of each species should be calculated to provide an adequate quantity of pure live seed (PLS) per unit area of each key component.

11.22. Aim for density of about 140 seedlings/m^2 at the end of the first growing season to provide adequate ground cover and allow native species to re-colonize the site over time.

11.23. Consider that parameters such as seed lot purity, seed germination, seedling establishment, seed size and seeding method affect the final stand composition.

6.43 Seeding

11.24. Use approved native seed mixes developed for site-specific conditions for various elevations.

11.25. Seed and stabilize (e.g. mulch/tackifier) bare areas as soon as possible after disturbance,

preferably as soon as a significant area is graded and finished and before the next rain event. If there is a risk of seedling mortality as a result of fall frost stabilize until appropriate growing conditions exist.

11.26. Use sod in high traffic areas or places that need extra erosion control. Source sod grown from native species (often called fescue sod) and ensure adequate anchoring and watering is in place.

11.27. Use temporary seeding when outside the seeding dates for permanent vegetation

11.28. Apply a seed mixture which is appropriate for the climate, soil, and drainage conditions of the site.

11.29. Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions.

11.30. Conduct broadcast seeding under calm wind conditions. Hydro-seeding is acceptable where access is available.

11.31. Do not exceed 30 kg/ha for the broadcast method, ensure seed is integrated with the soil by light rake or harrow. Broadcast method seeding rate is 25 kg/ha (2.5g/m^2) (e.g., 1x25 kg bag will cover 10,000m^2 or 1 hectare).

11.32. For hydro-seeding do not exceed 75 kg/ha with light mulch rates (500 kg/ha- of mulch with hydro-seeding) and 150 kg/ha with heavy mulch rates (1500 kg/ha of mulch with hydro-seeding).

11.33. Do not increase the seeding rate to compensate for poor seedbed conditions.

11.34. Monitor temporary erosion control measures to prevent seed loss.

11.35. Some seeding procedures may have to be completed or repeated in subsequent years.

6.44 Alternatives to Seeding

11.36. Use topsoil seed bank in small areas when there is no risk of erosion or competition from invasive species (i.e., natural regeneration).

11.37. Use native transplants in areas where conventional seeding applications are not applicable or where slope stability is an issue.

11.38. Use conventional forestry planting methods for container grown transplants, see website for guidance.

6.45 Reclamation Standards

11.39. Minimum standard for plant density is 25 plants/m^2, with 90% frequency.

11.40. Minimum standard for plant cover is 80% ground cover, with 90% frequency.

11.41. Minimum standard for plant community composition standard is 50% cover and 90% frequency of native species.

11.42. Exclude species designated as weeds in the work sites from the plant density standard consult local vegetation ecologist for current site specific non-native vegetation management program.

11.43. Rock, plant litter and non-vascular species are included in the cover standard.

11.44. Remaining plant cover of seeded native species is acceptable.

6.46 Reclamation Plot Evaluation

11.45. Select any site within reclamation area measuring 10 x 10 m, providing 100 plots of 1 square

meter.

11.46. Measure the plant density, cover and composition in each of the 100 square meter plots.

11.47. The reclamation standard will have been met if 90 of the 100 plots match or exceed the criteria.

11.48. No fertilizer will be applied one year before the reclamation standard is evaluated.

6.47 Time Limits

11.49. Inspect site annually during the growing season.

11.50. Minimum reclamation standard, as above, to be met within one season post planting.

11.51. Apply amendments annually, depending on reclamation progress.

11.52. Re-seed site if the plant density standard is not expected to be achievable within 5 years.

- A new restoration plan will be prepared and implemented when reclamation standards have not been met after 5 years.

12. Drainage Structures Mitigations Module

Drainage structures on roadway, highway and parkways are structures such as culverts, ditches and drains. Drainage structure management activities are undertaken to ensure that surfaces are safe and efficiently drained, water is efficiently channeled to ditches and watercourses, and erosion of highways and adjacent properties is prevented. These mitigations include the cleaning and maintenance of drainage structures and related hardware, as well as the repair or replacement of existing and installation of new drainage structures.

6.48 Timing of Works

12.1. Time work in water to respect **timing windows** to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics specialists and DFO offices for further information on **timing windows** in your region.

12.2. Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.

12.3. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

12.4. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

6.49 Drainage Structures

12.5. Isolate your work area from any flowing water that may be present. Ensure any flows are temporarily diverted around the portion of the ditch or watercourse where you are working.

12.6. Select appropriate equipment and work access routes to reduce damage to riparian vegetation and watercourse banks when using earth-moving equipment.

12.7. For smaller scale debris and sediment removal activities, remove materials by hand.

12.8. To assist with bank stability and invasive plant prevention, leave topsoil and root systems intact on channel banks surrounding your work area.

12.9. Ensure any works to repair damaged structures retain the pre-repair channel conditions (e.g., streambed profile, substrate, channel cross section) and do not constrict the stream width.

12.10. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.

6.50 Culverts

If a proposed culvert crosses a stream where fish are present, the crossing should be designed or upgraded to provide fish passage and avoid interference with fish habitat. To mitigate the impact of culverts on fish movement technical assessment of the water flows and fish species is required to establish a culvert design that will allow for passage of fish. Often there are regional or provincial best practices available online and qualified professionals can assist with designs. Some best management practices for installation or replacement of culverts follows.

6.50.1 *Culvert Design and Alternatives*

Utilize alternative crossing structures (e.g. clear span bridges, lock blocks and concrete decks) as a replacement for culverts, where possible.

12.11. Ideally, crossings should have natural streambed material through them to allow continuous substrate that matches the streambed below and above the crossing. Open bottom crossings are ideal for maintaining natural substrate.

12.12. Utilize a single large culvert design over a multiple culverts design (i.e. several smaller culverts) to reduce debris blockage and increased fish and wildlife passage, where hydrologically feasible

12.13. Design culvert bottoms to be placed at least 30cm below the stream bed elevation to ensure culverts remain passable by fish and wildlife by preventing culverts from becoming perched.

12.14. A minimum water depth of 200 mm should be provided throughout the culvert length. To maintain this water depth at low flow periods an entrance/downstream pool can be constructed. In some cases, an upstream pool may also be necessary.

12.15. The culvert slope should follow the existing streambed slope where possible.

12.16. The culvert, inlet(s) and outlet(s) should be adequately protected with rip-rap to prevent erosion and scour around the culvert during high runoff events. The following measures should be incorporated when using replacement rock to stabilize the culvert:

- Place appropriately-sized, clean rocks into the eroding bank area by hand or machinery operating outside the water course.
- Do not obtain rocks from below the ordinary high water mark of any water body.
- Where possible, install rock at a slope similar to the stream bank to maintain a uniform stream profile and natural stream alignment. Otherwise, install the rock at the closest slope required to ensure it is stable.
- Ensure rock does not interfere with fish passage or constrict the channel width.

12.17. Trash racks should not be used near the culvert inlet. Accumulated debris may lead to severely restricted fish passage and potential injuries to fish. Where trash racks cannot be avoided in culvert installations, they must only be installed above the water surface indicated by bank full flow. A minimum of 9 inches clear spacing should be provided between trash rack vertical members. If trash racks are used, a long term maintenance plan must be provided along with the design, to allow for timely clearing of debris.

12.18. Natural or artificial supplemental lighting should be considered in new or replacement culverts that are over 150 feet in length.

12.19. Ensure designs locate culvert structures in areas that minimize impacts to riparian vegetation and associated wildlife.

6.50.2 *Culvert Installation*

12.20. It may be necessary to exclude fish from the immediate construction site while a culvert is being installed. If this practice is necessary, fish shall be salvaged by a qualified aquatics professional from within the exclusion area.

12.21. If dewatering is required refer to the dewatering mitigation module of this BMP for appropriate mitigations.

12.22. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.

12.23. Remove any old structures to a suitable upland disposal facility away from the riparian area and floodplain to avoid waste material from re-entering the watercourse

6.50.3 *Wildlife Considerations for Culverts*

At times, culverts are placed along portions of highways that bisect wetlands or specific habitats that support an abundance of wildlife. Consider building natural rock ledges through culverts to allow for small and medium-sized animals to walk on during periods of high flow.

13. Bridge Maintenance Mitigations Module

Bridge structure management activities include the cleaning and painting of bridge structures as well as the repair, rehabilitation, and replacement of bridge elements including decks, railings, abutments, and bearings. Works may include asphalt, concrete works, chipping, painting, grouting, timber truss, abutment and piling maintenance. These activities help ensure bridge structures remain structurally sound and safe for public use.

6.51 Timing of Works

13.1. Time work in water to respect **timing windows** to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics ecologists, provincial jurisdictions and DFO offices for further information on **timing windows** in your region.

13.2. Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.

13.3. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

13.4. Cover or otherwise contain stockpiled materials during heavy rain events or extended absences.

13.5. If the work schedule requires working in the rain, the area of work must be isolated with appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

6.52 Bridge Cleaning

13.6. Schedule bridge-cleaning activities to coincide with the watercourse's spring freshet when possible. At freshet or during periods of high flow a large watercourse will often have its highest background levels of sediment. At this time, the introduction of a small amount of sediment to a watercourse

(from bridge cleaning) will have a lower risk of potential impact when considered against those high natural background levels.

13.7. If works are planned outside the freshet or if your region does not experience a freshet, discuss the protocol and timing of these works with your local aquatics ecologist and/or DFO Officer.

13.8. Dry sweep and collect loose material off bridge surfaces before washing the bridge. Adequately seal drains and any open joints on the bridge deck before sweeping or washing to prevent material or sediment-laden wash water from entering any watercourse

13.9. If dry sweeping and preventing direct runoff to waterway is not a feasible way to clean the surface, discussion and planning with local aquatic ecologists will be required.

13.10. Use water alone. If your cleaning activities require degreasers or any other chemical, approval for use must be obtained from local aquatics specialists and/or DFO.

13.11. Contain any wash water or runoff to the bridge deck. Direct wash water towards the bridge approaches and away from the watercourse, then to a vegetated area or contained settling area (e.g., dry ditch channel unconnected to a watercourse) where it can infiltrate.

13.12. If superstructure cleaning is undertaken above or on the bridge deck level, prevent potentially harmful materials from entering into road drains. Block deck drains with suitable barriers (e.g., polyethylene or drain blocks) to prevent direct discharge to a watercourse, or re-route runoff through temporary piping onto adjacent settling pond or structure, using a hydro vacuum would be another option.

13.13. If water for cleaning is extracted from a watercourse, refer to water withdrawal section of this BMP.

6.53 Repairs Using Treated Wood Products

13.14. Untreated wood products are recommended, if treated wood is to be used, ensure it has been treated with a wood preservative appropriate for the project. Refer to the Parks Canada Guide for the Use, Handling and Disposal of Pressure Treated Wood 2009 and any further updates from Parks Canada Real Property – Environmental Management.

13.15. If treated timber must be cut to size, ensure cutting takes place away from the bridge and watercourse. Sawdust from treated wood is harmful to aquatic organisms and must be prevented from entering any watercourse.

13.16. Wood preservatives should be applied in a contained area and not be applied over or within 200m of water.

6.54 Bridge and Structure Painting

13.17. Ensure paint flakes, abrasive grits and abrasive/paint flake mixtures do not enter the watercourse as they may leach toxic heavy metals into receiving waters and/or be ingested by fish.

13.18. Install ground covers and/or vertical drapes such as sheets of plastic or air-permeable cloth (e.g., burlap or canvas) prior to removal activities to capture falling debris. Floating barges may be deployed in watercourses to capture falling debris, such as paint flakes and dust.

13.19. Waste materials collected during removal and application of protective coating operations (e.g., blasting abrasives, paint particles, rust and grease) should be collected and retained for disposal at appropriate locations. Waste materials must not be deposited into watercourses or riparian areas.

13.20. Use hydro blasting or manual techniques, where possible, when removing road dirt, soluble salts and loose paint to minimize impacts to the watercourse.

13.21. Use water without cleaning agent additives if grease film removal is necessary.

13.22. Avoid use of toxic liquid paints, primers, solvents, degreasers and rust inhibitors.

13.23. Minimize spill potential by storing, mixing and transferring paints and solvents on land.

14. Water Withdrawal and Dewatering Mitigations Module

Construction often requires the use of water, many common methods of excavation and site isolation require dewatering. Temporary, short term water withdrawal provides an efficient uncontaminated water source for local project sites. Dewatering can allow sites to be effectively dry during construction, reducing the impact of sediment laden water entering fish bearing waters.

6.55 Timing Windows

14.1. As a general guide to prevent taking more water than aquatic system can support, limit total take of water to less than 5 successive days and less than 10 days in any period of 30 days.

14.2. Avoid water withdrawal during breeding seasons of amphibians and reptiles to avoid destruction of egg masses, consult local aquatics ecologist for site specific guidance.

6.56 Water Withdrawal

14.3. Water should not be withdrawn from a wetland or stream less than 5 metres wide at the surface or a lake less than one hectare in area.

14.4. Water withdrawal should follow the 10/90 rule which allows for up to 10% of the stream flow to be withdrawn, as long as the stream flow does not fall below the 90% exceedence flow (eg.1 in 10 chance in a given year).

14.5. No permanent or semi-permanent works for water withdrawal should be placed in the stream channel.

14.6. Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish, amphibians and/or reptiles. Entrainment occurs when a fish or amphibian is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish, reptile or amphibian is held in contact with the intake screen and is unable to free itself.

6.57 Pump Screens

14.7. In freshwater, fish-bearing waters design and installation of intake end-of-pipe fish screens:

- Locate screen in areas and depths of water with low concentrations of fish throughout the year away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
- Orient the screen face in the same direction as the flow of water.
- Ensure openings in the guides and seals are less than the opening criteria to make "fish tight".
- Screens should be located a minimum of 300 mm (12 in.) above the bottom of the

watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.

- Provide structural support to the screen panels to prevent sagging and collapse of the screen. Large cylindrical and box type screens should have a manifold installed to ensure even water velocity distribution across the screen surface. The end of the structure should be made of solid materials and the end of the manifold capped.
- Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where debris loading (woody material, leaves, algae mats, etc.) is a concern. A 150 mm (6 in.) spacing between bars is typical.
- Provision should be made for the removal, inspection, and cleaning of screens.
- Ensure regular maintenance and repair of cleaning apparatus, seals, and screens to prevent debris fouling and impingement of fish.
- Pumps must be shut down when fish screens are removed for inspection and cleaning.

6.58 Dewatering

14.8. A site specific dewatering plan is required be provided before commencing a pump-out sump to dewater excavation sites with specific details on how and where the water will be discharge.

14.9. Site specific mitigations may be required depending on the conditions of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond reclamation.

14.10. Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the SO.

14.11. Soil and vegetation erosion protection is required for water pumped on to land.

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8 Appendix 1 Regulatory Guidance

8.1 Jurisdictions

While all projects on lands managed by Parks Canada must adhere to Federal law and regulation, it is considered best practice to refer to local community, regional, provincial regulation and best practices where federal guidance is silent and/or attempt to meet those targets if it can reduce the overall impact of the project.

Some of the project activities reviewed have potential environmental impacts that are addressed by various provincial, federal and territorial acts and regulations. All activities must meet current environmental law and regulations in their design and construction. The following is a brief description of some of the key federal acts and regulations. Further review, understanding and application of other federal, provincial and territorial environmental laws are part of a rigorous approach to project planning and execution.

8.2 *Canada National Parks Act* and Regulations-Parks Canada

All work inside National Parks and Protected Areas must be performed in accordance with the laws and regulations set out in the *Canada National Parks Act* and Regulations. This includes the requirement for most activities described to only be done under a permit such as: business licence for contractor, disturbance of natural objects, travel in restricted areas, special events or use of disposal sites.

8.3 *Fisheries Act* - Fisheries and Oceans Canada

If a project is to be conducted near water, it is the proponent's responsibility to ensure they avoid causing serious harm to fish in compliance with the Fisheries Act. The advice in on the Fisheries and Oceans website will help a proponent avoid causing harm and comply with the Act.

If the water body in the project area has fish or is connected to waters at any time that have fish the project must meet the self assessment criteria on the Fisheries and Oceans website, if not a project review can be made by Fisheries and Oceans Canada to assess whether the project requires authorization or authorization can be requested directly. Given the level of detail required for a review and/or authorization request the EIA officer may need to consider a more involved EIA pathway in those circumstances.

8.4 Migratory Bird Convention Act – Environment Canada

The purpose of this Act is to implement the Convention by protecting and conserving migratory birds - as populations and individual birds - and their nests. Section 6 - prohibits the disturbance, destruction, or taking of a nest, egg, or nest shelter of a migratory bird.

In Canada, the general nesting period may start as early as mid-March and may extend until end of August. This is a general nesting period that covers most federally protected migratory bird species. This period varies regionally across Canada mainly due to differences in species assemblages, climate, elevation and habitat type. Generally, the nesting period is delayed in more northerly latitudes, corresponding to vegetation development and food availability. (Environment Canada, 2014). To help with determining regionally relevant periods where nesting is likely to occur, Environment Canada is publishing estimated regional nesting periods within large geographical areas across Canada referred as "nesting zones". These periods are estimated for each zone and

consider the time of first egg-laying until the young have naturally left the vicinity of the nest. Field Units may wish to refine this section and add their known local nesting periods.

8.5 Species at Risk Act

If a species listed under the *Species at Risk Act* (SARA) is found within the project area, any potential adverse effects from the proposed project to the individuals of the species, their residences and/or their critical habitat must be understood. Species at risk considerations require specific expertise, due to additional legal requirements under the SARA and CEAA 2012. If the projects or activities to be addressed by the BMP could affect a listed species or its critical habitat, the EIA officer may need to consider a more involved EIA pathway in those circumstances.