Public Works and Government Services Canada

Requisition No: _____

DRAWINGS & SPECIFICATIONS
for
Channel C Culvert Replacement

Mountain Institution (Project No. R.082938.001)
Agassiz, BC

September 2018

APPROVED BY:

Regional Manager, AES	Date: Sept. 17/18
Construction Safety Coordinator	Date: 2018-09-13

TENDER:

Project Manager	Date: 2018-09-17

Real Property Services Branch, Professional and Technical Services, Pacific Region
Room 219 - 800 Burrard Street, Vancouver, B.C., V6Z 0B9

SCHEDULE OF QUANTITIES

LIST OF DRAWINGS (Bound Separately)

Sheet No.	Description
01	Location & Index
02	Proposed Culvert
03	Culvert Details

2018-09-17

Environmental Management Plan, Mountain Institution Channel C Culvert Replacement, prepared by ISL, September 2018 - Attached

1. CODES

.1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date.

2. DESCRIPTION OF WORK

.1 Work under this Contract comprises construction at Mountain Institution near Agassiz, BC. Work includes removal of existing CSP and concrete box culvert, installation of new 1800mm diameter CSP culvert with headwalls and site restoration. The work will occur along channel C under the west access road to the Mountain Institution.

.2 Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract documents:

.1 Submit Traffic Management Plan to Departmental Representative for review prior to mobilizing to site. Arrange for satisfactory clearance from CSC for all workers on site in advance.

.2 Instream work to be completed in the dry.

.3 Remove existing culvert and prepare subgrade.

.4 Install 1800mm diameter CSP culvert, headwalls and complete channel improvements.

.5 Complete site restorations including asphalt paving of access roadway and security gates.

.6 Provide the Department Representative with all test reports and final documentation.

3. 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.

4. OTHER CONTRACTS

.1 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.

.2 Coordinate work with that of other Contractors (if applicable). 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.

5. 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.

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

6. TIME OF COMPLETION

.1 Total completion of the site work shall be no later than 4 weeks from contract award date.

7. HOURS OF WORK

.1 Hours of work shall accommodate operation of the Mountain Institution, which is a 24/7 facility operation.

8. WORK SCHEDULE

.1 Carry on work as follows:

.1 Within 5 working days after Contract award, provide a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:

.1 Submission of shop drawings, product data, MSDS sheets and samples.

.2 Commencement and completion of work of each section of the specifications or trade for each phase as outlined.

.3 Final completion date within the time period required by the Contract documents.

.2 Do not change approved Schedule without notifying Departmental Representative.

.3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

9. COST BREAKDOWN

.1 Before submitting the first progress claim, submit a breakdown of the Contract unit prices in detail and as directed by the Departmental Representative and aggregating Contract price, for the details shown in the schedule of quantities provided.

10. CODES, BYLAWS, STANDARDS

.1 Perform work in accordance with the National Building Code of Canada, and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application, including MMCD (Platinum) Edition.

.2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.

.3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.

.4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

11. DOCUMENTS REQUIRED .1 Maintain 1 copy each of the following at the job site:
- .1 Contract drawings.
- .2 Contract specifications.
- .3 Addenda to Contract documents.
- .4 Copy of approved work schedule.
- .5 Reviewed/approved shop drawings.
- .6 Change orders.
- .7 Other modifications to Contract.
- .8 Field test reports.
- .9 Reviewed/approved samples.
- .10 Manufacturers' installation and application instructions.
- .11 One set of record drawings and specifications for "as-built" purposes, and
- .12 Current construction standards of workmanship listed in technical Sections.

12. 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 installed conforms with the requirements of the authority having jurisdiction.

13. CONTRACTOR'S USE OF SITE .1 Site located on Mountain Institution property at Agassiz, BC.

.2 Use of site:
- .1 Assume responsibilities for work areas for performance of this work.
- .2 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
- .3 Perform work in accordance with Contract documents. Ensure work is carried out in accordance with indicated phasing.
- .4 Do not unreasonably encumber site with material or equipment.

.5 Accept liability for damage, safety of equipment and overloading of existing equipment.

.6 Provide portable toilet for use by crew during construction.

.3 The Mountain Institution will remain fully operational during entire construction period and the contractor is expected to work with CSC to minimize any disruptions.

.4 Co-operate with Department Representative in scheduling operations to minimize conflict with CSC or public.

.6 Execute work with least possible interference or disturbance to the operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

.7 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.

.8 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

.9 Attend progress, safety and site security orientation meetings.

14. EXAMINATION

.1 Examine site and be familiar and conversant with existing conditions likely to affect work.

.2 Provide photographs of existing conditions, objects and structures prior to the start of the project.

15. EXISTING SERVICES

.1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give the Departmental Representative 48 hours notice for necessary interruption throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic and tenant operations.

.3 Provide alternative routes and parking access for personnel and pedestrian and vehicular traffic as applicable.

.4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

.5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Full closure of the access road will be permitted during construction.

.7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.9 Record locations of maintained, re-routed and abandoned service lines.

16. LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain his approval for actual location.

.4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

17. SETTING OUT OF WORK

.1 Assume full responsibility for and execute complete survey layout of work to locations, lines and elevations indicated.

.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.

18. QUALITY OF WORK

.1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.

.2 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

19. 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.

.2 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.

.3 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
- .1 Pay particularly close attention to overhead work above ceilings and within or near to building structural elements.
- .2 Identify on coordination drawings, building elements, services lines, rough-in points and indicate location services entrance to site.
- .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
- .4 Publish minutes of each meeting.
- .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
- .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.

.4 Work cooperation:
- .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
- .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
- .3 Ensure disputes between subcontractors are resolved.

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

.6 Maintain efficient and continuous supervision.

20. APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 In accordance with Section 01 33 00, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.

.2 Allow sufficient time for the following:
.1 Review of product data.
.2 Approval of shop drawings.
.3 Review of re-submission.

21. PROJECT MEETINGS

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

22. TESTING AND INSPECTIONS

.1 See Section 01 45 00 - QUALITY CONTROL

.2 The contractor shall engage and pay for the services of an approved independent testing agency of test laboratory to complete all testing at indicated in Section 01 45 00.

.3 Employment of inspection / testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for re-testing and re-inspection.

23. AS-BUILT DOCUMENTS

.1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications for "as-built" purposes.

.2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.

.3 Closeout submittals in accordance with Section 01 78 00.

24. CLEANING

.1 Daily conduct 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.

25. ENVIRONMENTAL PROTECTION .1 Prepare an Erosion and Sediment Control Plan and provide monitoring and maintenance as per Section 01 35 43 – ENVIRONMENTAL PROCEDURES

.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 territorial regulations.

26. 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.

27. SYSTEM OF MEASUREMENT .1 The metric system of measurement (SI) will be employed on this Contract.

28. 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 and site requirements.

----------END OF SECTION----------

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Submit to the Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify the Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative’s review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow 5 working days for Departmental Representative's review of each submission.

.4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.6 Accompany submissions with transmittal letter, in duplicate, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.7 Submissions include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.

.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to adjacent work.

.8 After Departmental Representative's review, distribute copies.

.9 Submit one PDF of shop drawings for each requirement requested in specification sections and as Departmental Representative may reasonably request.

.10 Delete information not applicable to project.

.11 Supplement standard information to provide details applicable to project.

.12 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, transparency will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.13 The review of shop drawings by Public Services and Procurement Canada (PSPC) is for sole purpose of ascertaining conformance with general concept.
.1 This review shall not mean that PSPC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit WorkSafe BC status.

1.4 APPROVALS

.1 Approval of shop drawings: refer to Section 01 11 55, clause 20.0.

----------END OF SECTION----------

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 32 11 23-Aggregate Base Courses.

1.2 REFERENCES

.1 Manual of Uniform Traffic Control Devices for Streets and Highways for Canada, Transportation Association of Canada.

.2 Traffic Control Manual for Work on Roadways, BC Ministry of Transportation

1.3 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.2 Comply with most recent editions of the Traffic Control Manual for Work on Roadways published by the BC Ministry of Transportation and the Manual of Uniform Traffic Control Devices for Streets and Highways for Canada published by the Transportation Association of Canada.

.3 During progress of the Work, make adequate provision to accommodate normal traffic along roads and highways immediately adjacent to or crossing the works so as to cause minimum inconvenience to the general public and CSC.

.4 When working on travelled way:
.1 Place equipment in position to present minimum of interference and hazard to travelling public.
.2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
.3 Do not leave equipment on travelled way overnight.

.5 Do not close any lanes of road without prior approval of Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with instructions reference manuals.

.6 Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.

.7 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Departmental Representative.

1.4 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified reference manuals.

.3 Place signs and other devices in locations recommended in the reference manuals.

.4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

1.5 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in the reference manuals in following situations:

.1 When traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other blockage.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.7 At each end of restricted sections where pilot cars are required.

.8 Delays to traffic due to contractor's operators: maximum 5 minutes.

1.6 OPERATIONAL REQUIREMENTS

.1 Maintain existing conditions for traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by Departmental Representative to protect and control traffic.

----------END OF SECTION----------

1. REFERENCES

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

.2 National Building Code of Canada (NBC):
- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 The Canadian Electric Code (as amended)

.4 Canadian Standards Association (CSA) as amended:
- .1 CSA Z797-2009 Code of Practice for Access Scaffold
- .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
- .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 CSA Z1006-10 Management of Work in Confined Spaces.
- .5 CSA Z462- Workplace Electrical Safety Standard

.5 National Fire Code of Canada 2010 (as amended)
- .1 Part 5 - Hazardous Processes and Operations and Division B as applicable and required.

.6 American National Standards Institute (ANSI):
- .1 ANSI A10.3, Operations - Safety Requirements for Powder-Actuated Fastening Systems.

.7 Province of British Columbia:
- .1 Workers Compensation Act Part 3-Occupational Health and Safety.
- .2 Occupational Health and Safety Regulations
- .3 B.C. Ministry of Transportation and Infrastructure Traffic Control Manual for Work on Roadways (as amended)

2. RELATED SECTIONS

.1 Refer to the following current sections as required:
- .1 Submittals procedures: Section 01 33 00
- .2 Special Procedures for Traffic Control: Section 01 35 00.06

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.

4. COMPLIANCE WITH REGULATIONS

.1 PSPC may terminate the Contract without liability to PSPC where the Contractor, in the opinion of PSPC, 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.

5. SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review. (in accordance with Section 01 33 00)

.2 Work effected by submittal shall not proceed until review is complete.

.3 Submit the following:

.1 Site Specific Health and Safety Plan.
.2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
.3 Copies of incident and accident reports.
.4 Complete set of current Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
.5 Emergency Procedures.

.4 The Departmental Representative will review the Contractor's Site Specific Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.6 Submission of the Site Specific 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.

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.

7. HEALTH AND SAFETY COORDINATOR

.1 The Health and Safety Coordinator will:

.1 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.

.2 Be responsible for implementing, revising, daily enforcing, and monitoring the Site Specific Health and Safety Plan.

.3 Be on site during execution of work.

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 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site at night time (or provide security guard) as deemed necessary to protect site against entry.

9. PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Multi-employer work site.

.2 Federal employees and general public.

.3 Energized electrical services.

.4 Working in the open exposed to unpredictable weather.

10. UTILITY CLEARANCES

.1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work

.2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

11. 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.

12. WORK PERMITS

.1 Obtain specialty permits related to project before start of work.

13. FILING OF NOTICE

.1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

14. 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 (PPE) to be used by workers.
.6 Identify personnel and alternates responsible for site safety and health.
.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Site Specific Health and Safety Plan by PSPC shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

15. 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 Provide written rescue/evacuation procedures as required for, but not limited to:
.1 Work at high angles.
.2 Work in confined spaces or where there is a risk of entrapment.
.3 Work with hazardous substances.
.4 Underground work.
.5 Work on, over, under and adjacent to water.
.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

16. HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.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].
.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
.3 Provide adequate means of ventilation.
.4 The contractor shall ensure that the product is applied as per manufacturers recommendations.
.5 The contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

17. ASBESTOS HAZARD

.1 Carry out any activities involving asbestos in accordance with applicable Provincial Regulations.

.2 Removal and handling of asbestos will be performed as indicated.

18.ELECTRICAL SAFETY REQUIREMENTS

1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new

electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

19. ELECTRICAL LOCKOUT

1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

20. OVERLOADING

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

21. CONFINED SPACES

.1 Carry out work in confined spaces in compliance with Provincial Regulations.

22.FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

23.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.

.3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the DR is required prior to any gas or diesel tank being brought onto the work site

24.FIRE PROTECTION AND ALARM SYSTEM

.1 Fire protection and alarm systems shall not be:
- .1 Obstructed.
- .2 Shut off.
- .3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

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.

26. POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:
- .1 Site Specific 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 Floor plans or site plans.
- .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
- .8 Workplace Hazardous Materials Information System (WHMIS) documents.
- .9 Material Safety Data Sheets (MSDS).
- .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided

for workers and equipment, or as approved by the Departmental Representative.

27. MEETINGS .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

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 health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

----------END OF SECTION----------

PART 1 – GENERAL

.1 A notification was submitted to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development for the culvert replacement on August 24, 2018. Works can commence 45 calendar days after the submission. The contractor shall adhere to all terms and conditions of this notification application and the Mountain Institution Channel C Culvert Replacement Environmental Management Plan attached herein.

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 environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 FIRES

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

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site unless approved by Departmental Representative.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

.3 Safely dispose of wet concrete and pipe grout off-site in accordance with Municipal, Provincial and Federal authorities' requirements.

1.3 EROSION AND SEDIMENT CONTROL / DRAINAGE

.1 In stream works to be avoided during presence of flow in the channel.

.2 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust that complies with the most stringent requirements of the authorities having jurisdiction.

.3 The contractor shall inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.4 All work shall be undertaken and completed in such a manner as to prevent the release of sediment, silt, or sediment laden water, concrete or concrete leachate or any other deleterious substance into any ditch or water course.

.5 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.6 The contractor shall keep all portions of the work drained during construction until completion. Where necessary, catch water ditch shall be constructed along the tops of excavations or fill slopes to prevent water flowing into or over the excavated or filled area. The contractor will be responsible for the repair for the damage, directly resulting for their operations and for the removal or dirt or debris from existing system, which may be caused by or which may result from water backing up or overflowing through, from, or along any part of the work or adjacent properties. The contractor shall bear all costs associated with these repairs until works are complete and accepted by the Department Representative.

.7 The contractor shall modify and/or provide additional silt control measures as necessary to accommodate construction activities and satisfy the requirements or the governing agencies.

.8 The contractor shall maintain all silt control facilities on an as-needed basis

.9 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.10 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

1.4 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

1.5 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

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

1.6 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 INSPECTION

.1 The Contractor shall as part of the work perform, or cause to be performed, all tests, inspections and approvals of the work as required by the Contract Documents, and if a test, inspection or approval requires a representative sample of materials or workmanship the Contractor shall at the Contractor's own cost supply the labour and materials necessary to provide the sample.

.2 If any portion of the work is designated for special tests, inspections or approvals (either as a requirement in the Contract Documents, or by the Department Representative's instructions, or by the laws or regulations applicable at the place of the work), then:

.1 if the Department Representative is to perform or arrange for the test, inspection or approval the Contractor shall give the Department Representative timely notice requesting such test, inspection or approval; and

.2 if other authorities are to perform the test, inspection or approval the Contractor shall arrange for such test, inspection or approval and shall give the Department Representative timely notice of the date and time for such test, inspection or approval.

.3 Department Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Department Representative shall pay cost of examination and replacement.

.4 If the Contractor disagrees with Department Representative's determination of the Work not meeting the Specifications based on the results of inspection or testing required in the Contract Documents or ordered by the Department Representative, the Contractor may elect to carry out such further inspection or testing which the Department Representative agrees is acceptable for the purpose of determining whether the work complies with the requirements of the Contract Documents If such further inspection or testing determines that the Work is not in accordance with the requirements of the Contract Documents, then the Contractor shall correct such Work and pay the costs of the inspection and testing including all

costs of the correction and further testing. If such further inspection or testing determines that the Work is in accordance with the requirements of the Contract Documents, then then Department shall pay all costs of the inspection and testing.

.5 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 at the Contractor's own expense, and Contractor shall comply with such direction.

.6 The Contractor shall promptly provide the Department Representative with 4 copies of all certificates, inspection and testing reports required by the Contract Documents or ordered by the Department Representative.

.7 The Contractor shall not undertake any Work outside the working hours, as specified in the Contract Documents, which under the Contract Documents requires tests, inspection, or approval by the Department Representative unless the Contractor obtains the Department Representative's prior approval. The Contractor shall reimburse the Department for any additional costs incurred to provide tests, inspections or approvals outside such specified working hours.

.8 Independent Inspection / Testing Agencies will be engaged by the Contractor for purpose of inspecting and/or testing portions of the Work. Cost of such services will be borne by the Contractor.

.9 Submit for approval by Departmental Representative proposed Independent Inspection / Testing Agencies.

.10 Employment of inspection / testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.11 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 re-testing and re-inspection.

1.2. ACCESS TO WORK

.1 Allow Department 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.

1.3 TESTING FREQUENCY

.1 The following outlines the minimum testing frequency for various components of the Work:

.1 Asphalt Cores to confirm Density and Thickness:
- .1 One per 500m^2.
- .2 For asphalt pavement areas less than 500m2, pavement is deemed to have met specifications if results from all cores average the design thickness ± 5mm with no individual core greater than 10mm less than the design thickness.
- .3 Core holes shall be reinstated to the satisfaction of the Department Representative.

.2 Road Subbase and Granular Base Densities:
- .1 One per 500 sq.m.

.3 Sieve Analyses and Proctors:
- .1 One prior to commencing work.
- .2 One every 200 tonne.

.4 Asphalt Marshall Test:
- .1 One per asphalt type.
- .2 Minimum one per full paving day.

.5 Concrete:
- .1 One per 50m^3.
- .2 Minimum one per day.

.6 Trench Densities:
- .1 One per 100 lineal metres per 300mm lift.

1.4 REPORTS

.1 Submit copies of inspection and test reports to Departmental Representative. The inspection and certification report are to submitted in PDF format during the construction stage with hard copies included in the Close Out documentation.

1.5 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

----------END OF SECTION----------

PART 1 - GENERAL

1.1 REFERENCES

.1 Public Services and Procurement Canada (PSPC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions "C", In Effect as Of: May 14, 2004.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Departmental Representative or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Clear snow and ice from site to provide a safe working areas.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris. Dispose of waste materials and debris off site.

.6 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

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 waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds. Remove dirt and other disfiguration from exterior surfaces. Sweep and wash clean paved areas.

----------END OF SECTION----------

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00-Submittal Procedures.

.2 Section 01 45 00-Quality Control

1.2 SUBMITTALS

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

.2 Copy will be returned after final inspection with Departmental Representative comments.

.3 Revise content of documents as required prior to final submittal.

.4 Furnish evidence, for type, source and quality of products provided.

.5 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.6 Pay costs of transportation.

.7 Submit to Department Representative, final copies of all test reports completed for this project including compaction tests, granular material gradations, asphatic concrete densities, thickness and marshall characteristics, a minimum 2 weeks prior to Substantial Performance of the Work.

1.3 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 216 x 279mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by process flow, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS - EACH VOLUME .1 Table of Contents: provide title of project;

.1 Date of submission; names.
.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.5 AS-BUILTS .1 Maintain, in addition to requirements in General Conditions, one record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of blue line, opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:
- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections to provide certification that all works have been completed as specified and that works are ready for tie-in.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 01–Submittal Procedures.

.2 Section 03 30 02–Cast–In–Place Concrete.

.3 Section 31 23 33.01–Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 American Concrete Institute (ACI)
- .1 SP–66, ACI Detailing Manual 2004.
  - .1 ACI 315, Details and Detailing of Concrete Reinforcement.
  - .2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 143/A 143M, Standard Practice for Safeguarding Against Embrittlement of Hot–Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
- .2 ASTM A 775/A 775M, Standard Specification for Epoxy–Coated Reinforcing Steel Bars.
- .3 ASTM A 1064/A 1064M–17, Standard Specification for Carbon–Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .4 ASTM F3125/F3125M–15a, Standard Specification for high strength structural bolts, steel and alloy steel, heat treated, 120 ksi (830 MPa) and 105 ksi (1040 MPa) minimum tensile strength, inch and metric dimensions.

.3 Canadian Standards Association (CSA International)
- .1 CSA–A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA–A23.3, Design of Concrete Structures.
- .3 CAN/CSA– G30.18–09, Carbon Steel Bars for Concrete Reinforcement.
- .4 CAN/CSA– S16–09, Design of Steel Structures.
- .5 CAN/CSA– W186–M1990, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .6 CSA– W59–13, Welded Steel Construction (Metal Arc Welding).
- .7 CSA–G40.20–13/CSA–G40.21–13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 Reinforcing Steel Institute of Canada (RSIC)
- .1 RSIC, Reinforcing Steel Manual of Standard Practice.

.5 National Building Code of Canada 2015.

1.3 SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with ACI 315.

.3 Submit shop drawings including placing of reinforcement and indicate:
.1 Bar bending details.
.2 Lists.
.3 Quantities of reinforcement.
.4 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.

.4 Detail lap lengths and bar development lengths to CSA-A23.3.

.5 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

.6 Quality Assurance: in accordance with Section 01 45 01 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
.1 Mill Test Report: upon request, provide DEPARTMENTAL Representative with certified copy of mill test report of reinforcing steel.
.2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

PART 2 - PRODUCTS

2.1 MATERIALS

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

.2 Reinforcing steel: billet steel, grade as specified on contract drawings deformed bars to CAN/CSA-G30.12, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.16.

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

.5 Epoxy Coating of non-prestressed reinforcement: to ASTM A 775/A 775M.

.6 Galvanizing of non-prestressed reinforcement: to

CAN/CSA-G164, minimum zinc coating 610 g/m².
.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
.1 In this case, no restriction applies to temperature of solution.
.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
.1 Provide product description as described in PART 1 - SUBMITTALS

.7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1.

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

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

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1 and ACI 315.
.1 ACI 315R 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 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

2.4 STRUCTURAL STEEL WORK

.1 Unless noted otherwise on drawings:
.1 All structural steel shall conform to CAN/CSA-G40.20/G40.21-92 grade 300W.
.2 Welding shall be carried out in accordance with CSA W59.

.3 All steel plates, threaded rods, washers and nuts shall be galvanized in accordance with CAN/CSA G164-M92.

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 A 143/A 143M.

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, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete.
.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
.2 When paint is dry, apply thick even film of mineral lubricating grease.

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

.4 Minimum concrete cover to reinforcing steel, unless shown otherwise in the drawings:
.1 faces cast and permanently exposed against earth = 75mm
.2 inside faces of walls = 50mm
.3 slabs and other formed walls = 40mm

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

.6 Protect coated portions of bars with covering during transportation and handling.

.7 Splices shall be staggered so that no more than 50% of the reinforcing is spliced at any one location, unless shown otherwise on the drawings.

.8 All exposed edges of concrete to be chamfered 19mm.

3.4 FIELD TOUCH-UP .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

----------END OF SECTION----------

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 31 23 10-Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.1 ASTM C 260/C 260M, Standard Specification for Air-Entraining Admixtures for Concrete.
.2 ASTM C 309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.3 ASTM C 494/C 494M, Standard Specification for Chemical Admixtures for Concrete.
.4 ASTM C 1017/C 1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
.5 ASTM D 412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
.6 ASTM D 624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
.7 ASTM D 1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
.8 ASTM D 1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian Standards Association (CSA International)
.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.2 CSA A283, Qualification Code for Concrete Testing Laboratories.
.3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
.2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 CERTIFICATION

.1 Minimum 2 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
.8 Waterstops.
.9 Waterstop joints.
.10 Joint filler

.2 Provide certification from Materials Representative that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1

.3 Provide certification from Materials Representative that mix proportions selected will produce concrete of specified quality, durability and yield and that strength will comply with CAN/CSA-A23.1.

1.4 CONSTRUCTION QUALITY CONTROL

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

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

.3 Submit proposed quality control procedures for Departmental Representative's approval. Submit in accordance to 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Portland Cement: to CAN/CSA-5.

.2 Supplementary Cementing Materials: to CSA-A23.5.

.3 Water: to CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1.

.5 Air entraining admixture: to CAN/CSA-A266.1.

.6 Chemical admixtures: to CAN/CSA-A266.2. Departmental Representative to approve acceleration or set retarding admixtures during cold and hot weather placing.

.7 Grout:
.1 Provide grout certification prior to use.
.2 To be as specified in Contract Documents. Alternative to be approved by Departmental Representative.
.3 Use in accordance with manufacturer's recommendations.

.8 Curing Compound:
.1 To be spray applied, liquid type conforming to ASTM C309 containing a fugitive dye.
.2 To be applied in accordance with manufacturer's recommendations.
.3 Other curing methods such as sheet material and burlap mats, subject to DEPARTMENTAL Representative's approval.

.9 Premoulded Joint Fillers (expansion joint):
Bituminous impregnated fibre board: to ASTM D1751.

2.2 CONCRETE MIXES

.1 Proportion concrete in accordance with CAN/CSA-A23.1, Table 11. Alternative 1 and to specific design criteria specified on Contract Drawings.

2.3 FORMS

.1 Forms to CAN/CSA-A23.1.11.

.2 Free from surface defects for all concrete faces exposed to view.

.3 Form ties to be metal and of type such that no metal left within 25mm of concrete surface when forms removed.

2.4 FORM RELEASE AGENT

.1 Non-staining material type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do cast-in-place concrete work, including surface tolerances, finishing and field quality control, in accordance with CAN/CSA-A23.1 except where specifically stated otherwise.

3.2 FORMWORK

.1 Formwork to conform to shape, lines and dimensions shown on Contract Drawings.

.2 Formwork to be substantial, sufficiently tight to prevent leakage of mortar and braced and tied to maintain position and shape.

.3 Formwork to be unlined unless specified otherwise.

3.3 CONSTRUCTION

.1 Obtain Departmental Representative's approval before placing concrete. Providing minimum 24h notice prior to placing of concrete.

.2 Pumping of concrete is permitted only after Departmental Representative's approval of equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.5 Ensure placement and compaction procedures to CAN/CSA-A23.1 and to approval of Departmental Representative.

.6 Protect exposed surfaces from weather and vandalism during initial set period.

.7 Strip forms ensuring no damage to concrete.

.8 Ensure curing procedures consistent with weather and temperature conditions.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 Don not place load upon new concrete until authorized by Departmental Representative.

3.4 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless authorized otherwise by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form all joints as shown on Contract Drawings or as otherwise require. Install joint filler where applicable.

.3 Use 13mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to finished slab surface unless indicated at bottom.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 RELATED SECTIONS

1. Section 01 33 00–Submittal Procedures.
2. Section 32 11 23–Aggregate Base Courses.

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 AND SHOULDER GRAVEL .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.

----------END OF SECTION----------

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 31 05 16-Aggregate Materials.

.2 Section 33 42 13-Pipe Culverts.

1.2 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 Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.3 ASTM D 422-63, Standard Test Method for Particle-Size Analysis of Soils.
.4 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).
.5 ASTM D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort(2,700 kN-m/m^3).
.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-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)
.1 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-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

.1 Excavation classes: two class of excavation will be recognized; common excavation.
.1 Rock : solid material in excess of 1.00m ^{3} and which cannot be removed by means of heavy duty mechanical excavating equipment with 1.0m^3 bucket. Frozen material not classified as rock.
.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Topsoil:
.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other

litter, and free from cobbles, stumps, roots, and other objectionable material.

.3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.4 Unsuitable materials:
.1 Weak, chemically unstable, and compressible materials.
.2 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-8.1.
.2 Coarse grained soils containing more than 10% by mass passing 0.075 mm sieve.

1.4 QUALITY ASSURANCE

.1 Qualification Statement: submit proof of insurance coverage for professional liability by Contractor for temporary supports.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of BC, Canada. Provide in advance for review by Departmental Representative.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional Engineer who is registered or licensed in Province of BC, to design and inspect temporary utility supports, shoring, bracing and underpinning required for Work.

.5 Health and Safety Requirements:
.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 EXISTING CONDITIONS

.1 Buried services:
.1 Before commencing work establish location of buried services on and adjacent to site.
.2 Arrange with appropriate authority for relocation or temporary supports of buried services that interfere with execution of work: pay costs of temporary supports or relocating services.
.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs, as shown on the Drawings.
.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
.5 Prior to beginning excavation Work, notify applicable Departmental Representative, establish

location and state of use of buried utilities and structures.
.6 Confirm locations of buried utilities by careful soil hydrovac methods.
.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing/re-routing.
.9 Record location of maintained, re-routed and abandoned underground lines.

.2 Existing surface features:
.1 Conduct, with Departmental Representative, condition survey of trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, 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 as directed by Departmental Representative.
.3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
.1 Crushed, pit run or screened stone, gravel or sand.
.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 Table

Sieve Designation	Percent Passing
75mm	100
50mm	70-100
25mm	50-100
4.75mm	22-100
2.36mm	10-85
0.075mm	0-5

.3 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75mm, cinders, ashes, sods, refuse or other deleterious materials.

PART 3 – EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENT CONTROL

.1 All Erosion and Sediment Control to be completed as per Section 01 35 43 Environmental Procedures.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Sawcut pavement neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/ PROTECTION

.1 Protect existing features.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Protect natural and man-made features required to remain undisturbed.

.4 Protect buried services that are required to remain undisturbed, i.e. water and gas.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.
.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 33 – Health and Safety Requirements.

.2 During backfill operation:
.1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
.2 Do not remove bracing until backfilling has reached respective levels of such bracing.
.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500mm above toe of sheeting.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Culvert installation are to be done in dry conditions.

.2 Keep excavations free of water while Work is in progress.

.3 Provide for Departmental Representative’s review details of proposed dewatering methods.

.4 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.5 Protect open excavations against flooding and damage due to surface run-off.

.6 Dispose of water in a manner not detrimental to environment and property, or portion of Work completed or under construction.
.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.8 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated on the Drawings.

.2 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.3 Restrict vehicle operations directly adjacent to open trenches.

.4 Dispose of surplus and unsuitable excavated material off site.

.5 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.6 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.7 Correct unauthorized over-excavation as follows:
.1 Fill under bearing surfaces and footings with MMCD (2009) granular pipe bedding and surround material, Type 1 fill compacted to not less than 95% of modified Proctor maximum dry density.

.8 Hand trim, make firm and remove loose material and debris from excavations.
.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

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3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated, and compacted to 95% modified Proctor maximum dry density.

.2 Place bedding and surround material in unfrozen condition.

.3 Where culvert subgrade is sensitive to disturbance, and compaction is difficult, provide 300mm thickness of 19mm clear stone over non woven geotextile to surround the stone and provide a stable base under the Departmental Representative supervision.

3.10 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:
.1 Departmental Representative has inspected and approved installations.
.2 Departmental Representative has inspected and approved of construction below finish grade.
.3 Inspection, testing, approval, and recording location of underground utilities.
.4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 300mm compacted thickness. Compact each layer before placing succeeding layer.

.5 Backfill material to be free draining sand and gravel with no more than 5% passing the #200 sieve. Backfill shall be compacted in lifts to at least 95% modified proctor maximum dry density.

.6 Backfilling around installations:
.1 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
.2 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.30 m.

3.11 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Replace slope riprap and topsoil as directed by Departmental Representative.

.3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.4 Clean and reinstate areas affected by Work as directed by Departmental Representative.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation of polymeric geosynthetics used in revetments, retaining wall structures, filtration, drainage structures and roadbeds purpose of which is to:
.1 Separate and prevent mixing of granular materials of different grading.
.2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

1.2 RELATED SECTIONS

.1 Section 01 33 00–Submittal Procedures.

.2 Section 01 35 43–Environmental Procedures.

.3 Section 31 24 13–Roadway Embankments.

.4 Section 31 37 00–Rip–Rap.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
.1 ASTM A 123/A 123M, Standard Specification for Zinc (Hot–Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM D 4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
.3 ASTM D 4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide–Width Strip Method.
.4 ASTM D 4716, Test Method for Determining the (In–Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
.5 ASTM D 4751, 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, 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, Methods of Testing Geosynthetics – Mass per Unit Area.
.2 No.3, Methods of Testing Geosynthetics – Thickness of Geotextiles.
.3 No.6.1, Methods of Testing Geotextiles and Geomembranes – Bursting Strength of Geotextiles Under No Compressive Load.
.4 No.7.3, Methods of Testing Geotextiles and Geomembranes – Grab Tensile Test for Geotextiles.
.5 No. 10, Methods of Testing Geosynthetics

– Geotextiles – Filtration Opening Size.

.3 Canadian Standards Association (CSA International)
.1 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.4 MATERIAL CERTIFICATION

1. Submit samples in accordance with Section 01 33 01 – Submittal Procedures.

2. Submit a "General Product Certification Sheet" clearly showing "Minimum Average Roll Values", as governed by ASTM D4354. All values to meet or exceed specified requirements.

3. At least 2 weeks prior to commencing work, and prior to material being accepted on site, submit original manufacturer's "Mill Certificates", showing actual MINIMUM test values and clearly identifying roll and batch numbers. Any material arriving on site which does not meet or exceed accepted "Minimum Average Roll Values" or that are not identified on original manufacturer's mill certification document to be removed at no cost to Owner.

4. All rolls of geosynthetic arriving on site to be clearly labeled identifying roll and batch number, original manufacturer's product identification number, and width and length of material contained within roll.

1.5 DELIVERY, STORAGE AND HANDLING

1. During delivery and storage, protect geosynthetics from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

2. Use equipment that does not contact material itself during loading, unloading and handling. Slings or other lifting devices to provide adequate support without damaging material. Off-load in a minimum of steps directly to storage or installation area.

3. Sore all rolls of geosynthetic on smooth, flat surfaces raised above ground that provide continuous support to rolls. Maintain additional protective cover if rolls are to be stored in excess of 30 days.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

PART 2 – PRODUCTS

2.1 MATERIAL

1. Geosynthetic: non-woven synthetic fibre fabric, supplied in rolls as shown on Contract Drawings.

2. Notwithstanding above, all specified properties represent "Minimum Average Roll Values" as governed by ASTM D4354.

3. Sewn seams (geotextiles) to be constructed using a 'j' configuration with 5 to 8 stiches per 25 mm in each of 2 lines of stitching separated by at least 12 mm. Stitches to be such that they will have an elongation at break equal to or greater than geosynthetic when tested in plane of seam. Ultimate grab strength perpendicular to seam to be equal to or exceed 90% of grab tensile strength or geosynthetic specified.

4. Thread for sewn seams (geotextiles) to have an equal or better resistance to chemical and biological degradation as that of geosynthetic. For inspection purposes, thread used to be of a colour that will contrast with original geosynthetic. Threads comprising of any organic fibres (such as cotton) or nylon will not be accepted.

5. Seams for all other geosynthetics to be to manufacturer's recommendations.

PART 3 – EXECUTION

3.1 INSTALLATION

1. Where fabric seams are not sewn, ensure overlaps as shown on Contract Drawings, but under no circumstance less than 600mm.

2. When placing fabric which incorporates a sewn seam, place seam "thread up" to facilitate inspection and repair.

3. Place pins or staples, where used, at a maximum of 2 m intervals.

4. Minimum granular thicknesses:
    1. Minimum lift thickness, prior to compaction with non-vibratory equipment to be 300 mm.
    2. Minimum base course thickness prior to further compaction with vibratory equipment to be 600 mm (pre-compacted) as above.

5. Protect installed geosynthetic material from displacement, damage or deterioration before, during

and after placement of material layers.

6. After installation, cover with overlying layer within 4h of placement.

7. Replace damaged or deteriorated geosynthetic to approval of the Departmental Representative.

8. Place and compact soil layers in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.

3.2 PROTECTION

1. Do not permit passage of any vehicle directly on geosynthetic at any time. Place fill by end-dumping or long-reach equipment.

2. Maximum drop height for fill directly onto geosynthetic to not exceed 1 m.

3.3 REPAIRS

1. Repair seams which open, and tears and punctures, by removing fill and resetting fabric. Additional geosynthetic to be placed over are, extending beyond perimeter of failure a distance corresponding to lapping requirements for project. Where practical, repaired geosynthetic to be pinned, bonded or stapled into place at intervals equal to or less than one-eighth perimeter of damage or 2 m, whichever is lesser.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 RELATED SECTIONS

1. Section 31 05 16–Aggregate Materials.
2. Section 31 32 19–Geosynthetics.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)
.1 ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
.2 ASTM C 618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.2 Canadian Standards Association (CSA)
.1 CAN/CSA–A23.1, Concrete Materials and Methods of Concrete Construction.
.2 CAN/CSA–A3000, Cementitions Materials Compendium.

PART 2 – PRODUCTS

2.1 STONE

.1 Clean angular hard fractured stone, with relative density (formally specific gravity) not less than 2.65, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution:

Class of Riprap (kg)	Approximate Average Dimension (mm)	Minimal Thickness of Riprap (mm)	Rock Gradation Percentage Larger than Given Rock Mass (kg)		
			85%	50%	15%
10	195	350	1	10	30
25	260	450	2.5	25	75
50	330	550	5	50	150
100	415	700	10	100	300
250	565	1000	25	250	750
500	715	1200	50	500	1500
1000	900	1500	100	1000	3000
2000	1130	2000	200	2000	6000
4000	1425	2500	400	4000	12000

2.3 GEOSYNTHETIC

.1 Geosynthetic: in accordance with Section 31 32 19 – Geosynthetic.

2.4 CEMENT MORTAR

1. Cement: to CAN3–A5 type 10.
2. Sand for mortar to: to CSA A82.56.

3. Mortar mix: 1 part cement to 3 parts sand, to consistency suitable for placement.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

1. Where required, excavate trench at toe of slope to elevations and dimensions as indicated on Contract Drawings or as directed by Departmental Representative.

2. Grade area to be riprapped to uniform, even surface. Fill depressions with approved material and compact to provide firm bed.

3. Grade out wave or surface water induced erosion of prepared bed prior to filter material and riprap placement.

3.2 PLACING

1. Commence placing riprap at toe of slope and continue placement working up slope.

2. Do not drop riprap if place above water.

3. Place riprap in accordance with thickness, elevation and surface tolerance details as shown on Contract Drawings.

4. Dress all riprap by reworking surface at least once so that voids are filled and riprap surface is well keyed, dense and uniform.

5. Hand placed riprap:
   .1 Use larger stones for lower courses and as headers for subsequent courses.
   .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
   .3 Finish surface evenly, free of large openings and neat in appearance.

6. Machine placed riprap:
   .1 Place riprap using suitable equipment.
   .2 Do not run equipment on finished riprap surfaces.

7. Mortar:
   .1 use mortar within one hour after water has been added. Do not add additional water after initial mixing.
   .2 Commence applying mortar at bottom courses (above low water line) and work upwards completely filling voids and leaving outer faces of stones exposed. Remove excess mortar to expose faces of stones.

.3 Cure and protect mortar in accordance with CAN3-A23.1 using absorptive mats or fabric kept continuously wet.

3.3 FINISHED TOLERANCES

1. Ensure finished riprap within +100mm to -100mm of specified grade.

2. Ensure stone filter thickness within +50 mm to -50mm of specified thickness.

3. Ensure riprap slope within +2 degrees to -2 degrees of specified slope in degrees.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 RELATED SECTIONS

1. Section 01 35 00.06 –Special Procedures for Traffic Control.

2. Section 31 05 16–Aggregate Materials.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM C 117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C 131, Standard Test Method for Resistance to Degradation of Small–Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN–m/m³).
- .5 ASTM D 1557–[00], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN–m/m³).
- .6 ASTM D 1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- .7 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.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused granular material from landfill to local facility as approved by Department Representative.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Material for road base to be:
- .1 Granular Base – 19 mm crushed gravel.
- .2 Refer to Section 31 05 16-Aggregate Materials for material specifications.

PART 3 – EXECUTION

3.1 INSPECTION OF UNDERLYING SUBGRADE SURFACE

.1 Ensure underlying subbase surface true to cross–section and grade and compacted to 98% Modified Proctor Maximum Dry Density. Do not place granular subbase until subgrade is inspected and approved by Department Representative.

3.2 PLACING

1. Place material only on clean unfrozen surface, properly shaped and compacted and free from snow or ice.

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

3. Place granular sub-base materials using methods which do not lead to segregation or degradation.

4. Place material to full width in uniform layers not exceeding 150mm compacted thickness. Department Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

5. Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

6. Remove and replace portion of layer in which material has become segregated during spreading.

3.3 COMPACTION

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

.2 Compact to density of not less than 98% Modified Proctor Density.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Department Representative.

3.4 SITE TOLERANCES

1. Ensure finished base within plus or minus 10 mm of specified grade and cross-section but not uniformly high or low.

2. Ensure finished surface has no irregularities exceeding 10 mm when checked with a 3 m straight edge placed in any direction.

3. Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 PROOF ROLLING

1. For proof rolling use fully loaded single or dual axle dump truck.

2. Department Representative may authorize use of other acceptable proof rolling equipment.

3. Proof roll top of base upon completion of fine grading and compaction.

4. Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

5. Where proof rolling reveals area of unsuitable subgrade:
   1. Remove base, subbase and subgrade material to depth and extent as directed by Department Representative.
   2. Backfill excavated subgrade with approved embankment material and compact to specified density.
   3. Replace granular subbase material and compact.
   4. Replace base material and compact in accordance with this Section.

6. Where proof rolling reveals areas of unsuitable base or subbase, remove unsuitable materials to depth and extent directed by Department Representative and replace with new materials,at no extra cost.

3.6 MAINTENANCE

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Department Representative.

----------END OF SECTION----------

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for asphalt concrete paving for roads and parking areas.

1.2 RELATED SECTIONS

1. Section 01 33 00-Submittal Procedures.
2. Section 01 35 14-Special Procedures for Traffic Control.
3. Section 31 05 16-Aggregate Materials.

1.3 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO)
- .1 AASHTO M320, Standard Specification for Performance Graded Asphalt Binder.
- .2 AASHTO R29, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
- .3 AASHTO T245, Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.2 Asphalt Institute (AI)
- .1 AI MS2 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

.3 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C 88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C 117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
- .3 ASTM C 123, Standard Test Method for Lightweight Particles in Aggregate.
- .4 ASTM C 127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .5 ASTM C 128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
- .6 ASTM C 131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 ASTM C 136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .8 ASTM C 207, Standard Specification for Hydrated Lime for Masonry Purposes.
- .9 ASTM D 995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- .10 ASTM D 2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.11 ASTM D 3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
.12 ASTM D 4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.4 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-16.3, Asphalt Cements for Road Purposes.

1.4 PRODUCT DATA

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

.2 Submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.

.3 Submit asphalt concrete mix design and trial mix test results to Department Representative for review at least 4 weeks prior to beginning Work.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

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

.4 Divert unused asphalt from landfill to facility capable of recycling materials.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Asphalt cement: to CAN/CGSB-16.3-M90, grade: 80-100.

.2 Reclaimed asphalt pavement:
.1 Crushed and screened so that 100% of RAP material passes 37.5 mm screen before mixing.

.3 Aggregates: in accordance with Section 31 05 16 - Aggregate Materials: General following requirements:
.1 Crushed stone or gravel consisting of hard, durable angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
.2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117.

.3 Table:

Sieve Size (UC#2)	Percent Passing
12.5 mm	100
4.75 mm	55–75
2.36 mm	38–58
1.18 mm	28–47
0.600 mm	20–36
0.300 mm	10–26
0.150 mm	4–17
0.075 mm	3–8

Sieve Size (LC#2)	Percent Passing
19 mm	100
12.5 mm	84–99
9.5 mm	73–88
4.75 mm	50–68
2.36 mm	35–55
1.18 mm	27–46
0.600 mm	18–36
0.300 mm	10–26
0.150 mm	4–17
0.075 mm	3–8

.4 Coarse aggregate: aggregate retained on 4.75mm sieve and fine aggregate is aggregate passing 4.75mm sieve when tested to ASTM C 136.

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

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

.7 Sand equivalent: ASTM D 2419 Min: 40.

.8 Magnesium Sulphate soundness: to ASTM C 88 Max% loss by mass after five cycles:
- .1 Coarse aggregate: 15%.
- .2 Fine aggregate: 18%.

.9 Los Angeles abrasion: Grading B, to ASTM C 131 Max % loss by mass:
- .1 Coarse aggregate, upper course: 25%
- .2 Coarse aggregate, lower course: 35%.

.10 Absorption: to ASTM C 127 Max % by mass:
- .1 Coarse aggregate, upper course: 1.75%.
- .2 Coarse aggregate, lower course: 2.00%.

.11 Loss by washing: to ASTM C 117 Max % passing 0.075 mm sieve:
- .1 Coarse aggregate, upper course: 1.5
- .2 Coarse aggregate, lower course: 2.0

.12 Flat and elongated particles: to ASTM D 4791, (with length to thickness ratio greater than 3): Max% by mass:
- .1 Coarse aggregate, upper course: 10%.
- .2 Coarse aggregate, lower course: 10%.

.13 Crushed fragments: at least 60% of particles by mass within each of following sieve designation

ranges, to have at least 2 freshly fractured face. Material to be tested according to ASTM C 136 and ASTM C117. Determination of amount of fractured material will be inaccordance with Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "B", which determines fractured faces by mass.

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

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

.4 Mineral filler:
.1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.
.3 Mineral filler to be dry and free flowing when added to aggregate.

2.2 EQUIPMENT

.1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:
.1 Minimum drum diameter: 1200mm.
.2 Maximum amplitude of vibration (machine setting): 0.5mm 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 not less than 12 kg 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, 3.0m in length, to test finished surface.

2.3 MIX DESIGN

.1 Mix design provided by the Contractor (to be developed by testing laboratory) for approval by Department Representative.

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

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

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

.2 Mix physical requirements:

Property	Roads	
Marshall Stability at 60°C	kN min	5.5 upper course 6.4 lower course
Flow Value	mm	2-4
Air Voids in Mixture	%	3-5 upper course 3-6 lower course
Voids in Mineral Aggregate	% min	15 upper course 2 14 lower course 2
Index of Retained Stability	% minimum	75

.3 Measure physical requirements as follows:

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

.2 Air voids: to ASTM D3203.

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

.4 Do not change job-mix without prior approval of Department Representative. When change in material source proposed, new job-mix formula to be reviewed by Department Representative.

PART 3 - EXECUTION

3.1 PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:

.1 To ASTM D 995.

.2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders. Do not load frozen materials into bins.

.3 Feed cold aggregates to plant in proportions to ensure continuous operations.

.4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.5 Before mixing, dry aggregates to moisture content not greater than 0.5% by mass or to lesser moisture content if required to meet mix design requirements.

.6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.

.7 Store hot screened aggregates in manner to minimize segregation and temperature loss.

.8 Heat asphalt cement and aggregate to mixing temperature directed by Department Representative. Do not heat asphalt cement above 160 degrees C.

.9 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.

.10 Mixing time:

.1 In batch plants, both dry and wet mixing times as directed by Department Representative. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.

.2 In continuous mixing plants, mixing time as directed by Department Representative but not less than 45s.

.3 Do not alter mixing time unless directed by Department Representative.

.11 Where RAP is to be incorporated into mix:

.1 Feed from separate cold feed bin specially designed to minimize consolidation of material. Provide 37.5mm scalping screen on cold feed to remove oversized pieces of RAP.

.2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti rollback device to prevent material from sliding backward on feed belt.

.3 Combine RAP and new aggregates in proportions as directed by Department Representative. Dry mix thoroughly, until uniform temperature within plus or minus 5 degrees C of mix temperature, as directed by Department Representative Consultant is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dried mix material is above 160 degrees C.

.2 Dryer drum mixing plant:

.1 To ASTM D 995.

.2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.

.4 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180 degrees C.

.5 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.

.6 Meter total flow of aggregate and RAP by an electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate RAP and asphalt entering mixer remain constant.

.7 Provide for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.

.8 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved. Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time. Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.

.9 Make provision for conveniently sampling full flow of materials from cold feed.

.10 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.

.11 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

.12 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each week, if required.

.13 Mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 0.5%.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 12 hour.

.4 Mixing tolerances:

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

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

.2 Permissible variation of asphalt cement from job mix: 0.3%.

.3 Permissible variation of mix temperature at discharge from plant: 5 degrees C.

3.2 EQUIPMENT

.1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Minimum drum diameter: 1200mm.

.2 Maximum amplitude of vibration (machine setting): 0.5mm 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 not less than 12 kg 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, 3.0m in length, to test finished surface.

3.3 PREPARATION

.1 Reshape granular road bed, if required.

.2 When paving over existing asphalt surface, clean pavement surface. When leveling course is not

required, patch and correct depressions and other irregularities to approval of Department Representative before beginning paving operations.

.3 Adjust existing castings to new elevations and protect from asphaltic mix.

.4 When matching new pavement with existing pavement make vertical cut between existing pavement and new pavement as shown on Contract Drawings.

.5 Apply prime coat and/or tack coat in accordance with Section 32 12 14–Asphalt Prime Coats and/or Section 32 12 15–Asphalt Tack Coats 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. Elevate truck bed and thoroughly drain. No excess solution to remain in truck bed.

.3 Schedule delivery of material for placing in daylight, unless Department Representative approves artificial light.

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

3.5 PLACING

.1 Obtain Department Representative's approval of base and existing surface and tack coat and 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 above 5 degrees C. Place overlay pavement only when air temperature is above 10 degrees C.

.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 Levelling courses to thicknesses required but not exceeding 100mm.
- .2 Lower course in layers of 100mm each.
- .3 Surface course in layers of maximum 60mm each.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.

.6 Spread and strike off mixture with self propelled mechanical finisher.
- .1 Construct longitudinal joints and edges true to line markings. Position and operate paver to follow established line closely.
- .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
- .3 Maintain constant head of mix in auger chamber of paver during placing.
- .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
- .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
- .6 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
- .7 Do not throw surplus material on freshly screeded surfaces.

.7 When hand spreading is used:
- .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
- .2 Distribute material uniformly. Do not broadcast material.
- .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
- .4 After placing and before rolling, check surface with templates and straight edges and correct irregularities.
- .5 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.6 COMPACTING

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

.2 General:

.1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one 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. For subsequent rolling do not exceed 5 km/h for static steel-wheeled and 8 km/h for pneumatic tired rollers.

.4 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.

.5 Overlap successive passes of roller by minimum of 200mm and vary pass lengths.

.6 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.7 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.8 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.9 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side. Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.10 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.

.11 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.3 Breakdown rolling:

.1 Commence breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.

.2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. Exceptions may be made when working on steep slopes or super-elevated sections.

.4 Use only experienced roller operators for this work.

.4 Second rolling:
.1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.5 Finished rolling:
.1 Accomplish finish rolling with steel wheel rollers while material is still warm enough for removal of roller marks.
.2 Conduct rolling operations in close sequence.

3.7 JOINTS

.1 General:
.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
.2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
.3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

.2 Transverse joints:
.1 Offset transverse joint in succeeding lifts by at least 600mm.
.2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
.3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:
.1 Offset longitudinal joints in succeeding lifts by at least 150mm.
.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
.1 For airfield runway paving, avoid cold joint construction in mid 30 m of runway.
.2 If cold joint can not be avoided, tack face with thin coat of hot asphalt prior to continuing paving.
.3 Overlap previously laid strip with spreader by 100mm.
.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 over onto previously placed lane inorder that 100 to150 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. Place and compact joint so that joint is smooth and without visible breaks in grade. Location of feather joints as indicated.

.5 Construct butt joints as indicated.

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

3.8 PAVEMENT PATCHING

.1 Ensure temporary and permanent pavement patching done by handwork conforms to all standards specified for machine place asphaltic concrete.

.2 Subbase and base preparation as specified in Section 32 11 16.01 and 32 11 23, respectively, unless shown otherwise on Contract Drawings.

3.9 SIDEWALKS, DRIVEWAYS AND CURBS

.1 Hot-mix asphalt concrete sidewalks, driveways and curbs as shown on Contract Drawings.

.2 Machine place where practical.

.3 Ensure placement by handwork conforms to all standards specified for machine placed asphaltic concrete.

.4 Other than requirements relating specifically to Portland cement concrete, ensure hot-mix asphalt concrete sidewalks and curbs comply with all requirements of Section 32 16 15-Concrete Walks, Curbs and Gutters.

.5 Ensure hot-mix asphalt concrete driveways comply with all requirements of Section 32 12 16-Asphalt Paving.

3.8 FINISH TOLERANCES

.1 Finished asphalt surface to be within 6mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 6mm when checked with 3 m straight edge placed in any direction.

.3 Water ponding not permitted.

.4 Against concrete gutter, finished asphalt surface to be higher than the gutter by not more than 6mm.

3.9 DEFECTIVE WORK

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

.1 Remove lids or covers from all castings and clean any prime, tack coat or hot-mix asphaltic concrete from frames, lids and covers of all castings.

----------END OF SECTION----------

PART 1 – GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submitted Procedures.

.2 Section 01 35 33 Health and Safety

.3 Section 01 35 43 Environmental Procedures.

.4 Section 31 05 16 Aggregate Materials.

.5 Section 31 23 33.01 Excavating, Trenching and Backfilling

1.2 REFERENCE STANDARDS

.1 CSA International
.1 CAN/CSA G401, Corrugated Steel Pipe Products.

1.3 SUPPLY AND DELIVERY BY OWNER

.1 The Owner will supply and deliver to site 22.0m of 1800mm x 3.5mm Corrugated Steel Pipe (CSP) in a 68mm x 13mm corrugation profile including coupler and gasket.

.2 Product Data: Manufacturer's instructions, printed product literature and data sheets for the culvert, including product characteristics, performance criteria, physical size, finish and limitations will be made available by the Owner.

.3 Coordinate deliver and receipt of materials with Departmental Representative. Products shall be made available for inspection and acceptance by the Departmental Representative at the time of delivery.

1.4 STORAGE AND HANDLING

.1 Store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:
.1 Store materials in accordance with manufacturer's recommendations.
.2 Store and protect segments from damage.
.3 Notify Departmental Representative of defective or damaged materials.

PART 2 – PRODUCTS

2.1 CORRUGATED STEEL PIPE

.1 The supply and fabrication of Corrugated Steel Pipe (CSP) and Structural Plate Corrugated Steel Pipe (SPCSP) including couplers and appurtenances shall be in accordance with the CSA Standard G401-07.

.2 Supply and delivery by Owner per clause 1.3.

PART 3 – EXECUTION

3.1 LAYOUT

.1 All culverts shall be laid out and constructed in general accordance with the lines, grades and locations specified in the Drawings, or as directed by the Departmental Representative.

3.2 TRENCHING

.1 The trench and other preparatory work shall be approved by the Departmental Representative before actual placing starts.

.2 A full trench condition shall be provided wherever possible; a minimum trench depth shall be 50% of the pipe culvert diameter.

.3 The material in the bottom of the excavation shall be reviewed by the Contractor's Geotechnical Engineer followed by a field memo sealed by a professional Engineer providing confirmation of (or recommendations to achieve) a firm and uniform foundation suitable for culvert placement.

3.3 PLACING

.1 CSP shall be laid beginning at the downstream end. With riveted CSP, the outside laps shall point upstream and the longitudinal joint shall be on the side. There is no directional restriction with helical CSP.

3.4 BACKFILLING

.1 Embedment material shall consist of mineral aggregate and shall meet the gradation specified in the following table:

Sieve Size (mm)	Percentage Passing
31.5	100
25	60–100
19	15–100
2.36	10–100
0.075	0–5

.2 Bedding material shall extend a minimum of 300mm below the culvert invert. The top of the bedding, upon which the pipe culvert is to be laid, shall be shaped so that at least 25% of the circumference of the pipe culvert is in contact with the prepared bedding for the whole of its length.

.3 Embedment material for embankment installation shall extend a minimum of two-thirds of the span or 0.9m beyond the culvert span on each side, whichever is greater. Embedment material for trench installation shall extend a minimum of 0.3m on either side.

.4 Embedment material shall be placed in layers not exceeding 150mm in depth when compacted. Embedment

material shall be compacted to a minimum 95% (100% within 300mm of subgrade elevation) of the laboratory density as determined in accordance with ASTM D698. Backfilling shall be done symmetrically. The differential height of backfilling material on either side of the culvert shall not exceed 300mm.

.5 The material within 450mm directly above the crown of the pipe culvert shall be laid and compacted as one lift. For a culvert with crown within 300mm of subgrade installation methods shall be approved by the Departmental Representative.

.6 When the air temperature is below 0°C, no backfilling is allowed unless otherwise accepted by the Departmental Representative. When acceptance is granted, all backfill materials shall be in a thawed state when placed and compacted. Frozen granular backfill materials will not be permitted. No backfill material will be permitted to be placed directly on frozen substrate.

3.5 CLEANING

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

----------END OF SECTION----------

ISL Engineering and Land Services

Inspiring sustainable thinking

Environmental Management Plan

Public Services and Procurement Canada

Mountain Institution Channel C Culvert Replacement

September 2018

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FIGURES

SCHEDULES

1 Background

Public Services and Procurement Canada (PSPC) retained ISL Engineering and Land Services Ltd. (ISL) to provide engineering and environmental services for the proposed Channel C Culvert Replacement Project ("project"), located to the west of the Mountain Institution in Agassiz, BC (Figure 1). Channel C is an ephemeral watercourse that is for a majority of the year, and only flows during snowmelt events. Culvert replacement is proposed to take place when the channel is dry, to avoid the need for temporary stream diversion, water quality issues, and potential aquatic wildlife encounters.

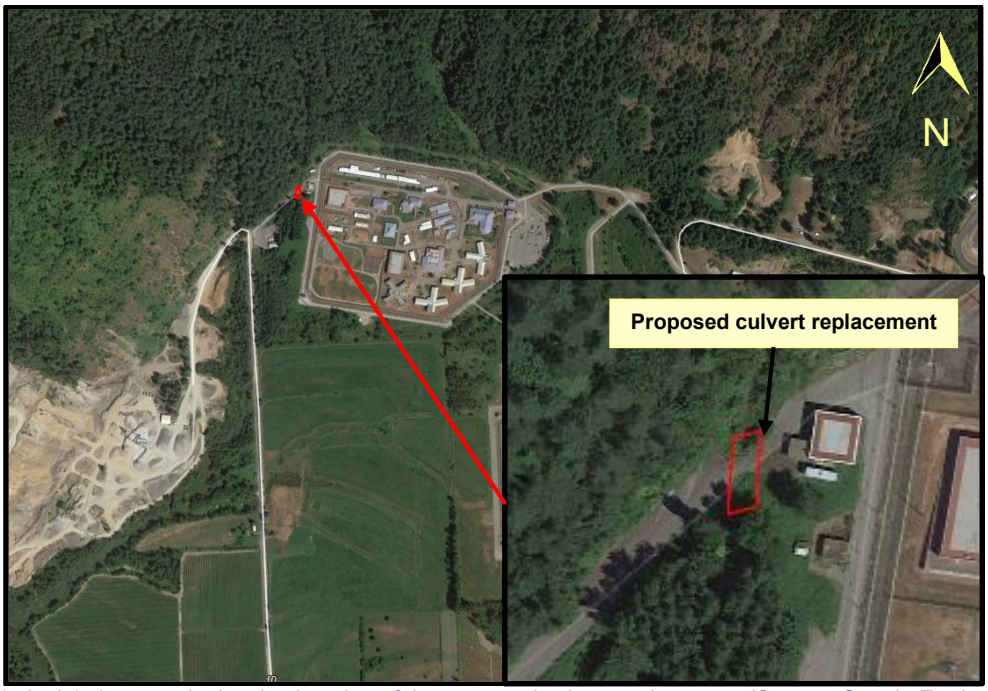


Figure 1. Aerial photograph showing location of the proposed culvert replacement (Source: Google Earth, 2018).

1.1 Applicable Environmental Legislation and Permits

ISL submitted this project as a Notification pursuant to the *Water Sustainability Regulation* (*WSR*) under Section 39 (1) (a) for removal and installation of a culvert crossing a stream for the purpose of a road. Other applicable legislation that apply to the project include:

- *Environmental Management Act*
- *Fisheries Act*
- *Species at Risk Act*
- *Wildlife Act*

1.2 Purpose of this Environmental Management Plan

The Environmental Management Plan (EMP) has been prepared by ISL for the use by PSPC and its Contractor during the culvert replacement within Channel C. The EMP provides over-arching guidance and expectation for the delivery of environmental impact mitigation by the Contractor concurrent with construction. The EMP cites applicable Best Management Practices (BMPs) and environmental regulatory requirements that the Contractor must implement in order to avoid

contravention of the federal *Fisheries Act, Species at Risk Act* and provincial *Water Sustainability Act (WSA)*.

2 Project Schedule

The culvert replacement works shall be completed between October 8, 2018 and October 31, 2018, when the channel is dry. The culvert replacement works will take between 5 to 10 business days, once started.

3 Environmental Monitoring

- An Environmental Monitor (EM) will be provided by ISL for the project.
- Prior to ground disturbing works on the site, a field pre-construction walk-through of the project site will be held amongst the EM, Engineering Inspector and Contractor's Site Supervisor (or Foreman) to walk the site and identify site specific risks, schedule and constraints.
- Environmental Monitoring will be part-time during construction due to dry site conditions and low impact activities.
- The EM will be notified a minimum of five (5) days prior to the start of the ground disturbing activities.

Environmental Monitor will:

- Have the authority to modify or halt any construction activity, if deemed necessary, for protection of fish and wildlife populations or their habitat.
- Direct the contractor on required protective or mitigatory measures to meet environmental regulatory requirements and applicable BMPs.
- Report Environmental Incidents or non-compliances to the regulatory agencies with jurisdiction and to the Site Supervisor, Engineering Inspector and Contract Administrator.
- Ensure that documentation, such as environmental mitigation, environmental notification and this EMP are available on site.
- Complete a Contractor Environmental Orientation at the site and prior to commencement of works (Schedule 1).
- Document observations, compliance, and construction progress and take photographs.
- At the completion of this project, complete and submit a copy of a post construction report consistent with the recommended standard format to the other relevant parties within 60 days of project completion. The report will document that construction has been completed and outline any difficulties encountered during the project.
- Not consider the project to be complete and in compliance with best practices for mitigating the works if there are any outstanding proposed mitigation measures that are incomplete.

4 Water Quality Objectives

The works are proposed to occur in the dry. In case water is present in the channel or channel bed, water quality downstream of active work site must meet or exceed limits outlined in the Fisheries

and Oceans (DFO) Land Development Guideline for the Protection of Aquatic Habitat applies to this project. The following site runoff water quality requirements apply to the project:

- Less than 25 mg/L of suspended solids above the background suspended solid levels of the receiving waters during normal dry weather operation; and
- Less than 75 mg/L of suspended solids above the background levels during design storm events.
- 6.5-9.5 of pH at discharge from the site.

5 Project Mitigation Measures

The following section describes the applicable mitigation measures that are proposed for the project. Implementation of the provided measures are recommended in order to mitigate the risk to aquatic and terrestrial habitats and ensure compliance with the applicable legislations, approvals and BMPs.

5.1 Species at Risk Protection

Five (5) species at risk were reported to occur in the vicinity of the site. No species at risk are anticipated to be encountered at the site during the works due to existing site conditions. If unforeseen circumstances were to arise and a species at risk is observed at the site, the Contractor shall:

- Temporarily cease work to allow the species to safely navigate away from the work site;
- Notify the EM; and
- Avoid touching, handling, harassing or harming the species.

5.2 Erosion and Sediment Control

The Contractor shall adopt and maintain good erosion control to reduce or eliminate sedimentation issues. For erosion and sediment control (ESC) to be effective on this site the following control measures will be required:

  - Prior to commencement of the work the contractor must obtain sufficient quantities of silt fence, straw bales, grass seed mix, sandbags, erosion control blanketing, polyethylene sheeting, mulch etc. necessary to stabilize disturbed ground.
  - These erosion and sediment control materials must be on-site, available for inspection and installation prior to the commencement of any ground disturbance, if deemed necessary by the EM.

- All works will be conducted in a manner that will prevent the release of sediment or sediment-laden waters to watercourses, ditches, storm sewers and swales draining to fish habitat.
- If deemed required by the EM, perimeter control measures such as straw wattles, silt fencing and / or rock mulch berms will be installed to ensure deleterious materials are not released into any of the surrounding drainages.
- All efforts will be made to leave undisturbed native vegetation, where possible.

- All disturbed slopes, watercourse banks and ground surfaces that may contribute sediment-laden water during precipitation events must be stabilized through application of organic (i.e. straw) or inorganic (i.e. rock or polyethylene) over the course of the project.
- Work will be pursued to completion as quickly as possible, once started.
- All work which involves heavy machinery that is disturbing earth material must be suspended during significant rainfall events (>25 mm over 24-hour period).
- No debris is to remain below the high water mark or placed into the stream.
- Soil stockpiles are to be set back well away from the streambank and covered with secured tarps.

5.3 Invasive Vegetation Management

In order to avoid the spread or introduction of invasive species at the site, the following mitigation measures shall be implemented:

- Any heavy equipment such as excavators, dozers, dump truck and packers coming from outside the region will be clean of any soil or vegetation debris prior to any earth works commencing to ensure there is no transportation of invasive plants from outside the region.
- No noxious weeds are anticipated at the work site; however, should any invasive plant species be found on-site, the contractor will contact the EM prior to disturbance.
- Any disturbed riparian area must be restored / re-planted prior to demobilization.

5.4 Waste Management

- There will be no disposal of solid wastes into ditches, streams, culverts, road edges or private property.
- The contractor will provide designated animal proof, waste bins for the disposal of non-hazardous solid wastes.
- All construction waste will be removed from the site on a regular basis.
- All solid waste will be either recycled or disposed of at approved waste disposal facilities.
- Littering is prohibited and monitoring for this activity will be on-going throughout the project.

5.5 Contaminated Soil Management

No contaminated material is anticipated to be present at the site; however, if suspect contaminated material is detected by sight or odor at the site, the Contractor shall temporarily cease works and contact the EM to ensure proper testing, handling, storage and disposal protocols are in place.

- If contamination is expected, soil samples will be collected from the excavation or stockpiled material following Contaminated Sites Regulation (CSR) protocols.
- The sample will be sent to a laboratory qualified to test for soil contaminants.
- If the analysis indicates that there is a potential source of contaminants, or if the contractor observes a visual or olfactory indicators for contaminated soil, then the contractor shall:

- Stop work and notify the EM and Contract Administrator (CA) who will advise the contractor on the course of action;
- If contaminated soils are to be temporarily stored onsite for analysis then they should be stored on polyethylene sheeting in a bermed off area and covered in weighted polyethylene sheeting; and
- Cover the area with the potential contamination with polyethylene sheeting.

- The EM will compare results from the lab analysis to the CSR Guidelines to determine the appropriate disposal location. Results from the soil contaminant testing will be reported to the CA.
- The Contractor will not be responsible for the off-site removal, transport or disposal of the identified contaminated material, as per this contract.

5.6 Concrete and Grout Mitigation Management

The Contractor shall undertake all concrete/grouting work with caution, as wet cement/grout is highly toxic to aquatic organisms. At a minimum, the following procedures shall be implemented by the Contractor:

- Cementitious material shall be stored a minimum of 30 m away from watercourses, unless approved by the EM.
- Remnant concrete or grout can be allowed to solidify in a non-permeable container (or polyethylene lined box) prior to proper disposal off-site. If this method is utilized, the container must not exceed 80% of its capacity and be protected from contact with the weather elements. Such container shall not be stored within 30 m of the channel.
- The Contractor must capture grout and drill wasting to prevent its entry to the aquatic environment through the use of berms, pits or tarpaulins.
- There shall be no contact of grouts and concrete with freshwater channels or ditches.
- Complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 72 hours.
- Any water that contacts uncured or partly cured concrete shall be isolated and held, or treated with CO^2 or Sodium Thiosulfate, until such time as the pH is between 6.5 and 9.0.
- Concrete dust from saw cutting and drilling shall be prevented from entering any watercourse.
- All wash water from concrete trucks must be contained in a wash bucket and shell be recycled back into the trucks and taken off-site for proper disposal.
- Exposed concrete will be covered, prior to forecast rains.
- All waste concrete / cementitious material shall be disposed of at an appropriate facility.
- The Contractor must follow *BC Environmental Management Act* – spill reporting regulation procedures relating to emergency mitigation and clean up measures for managing the cleanup and recover of concrete materials.

5.7 Hydrocarbon Mitigation Management

- Ensure equipment and machinery are in good operating condition, free of leaks, excess oil, and grease.
- All stationary gas and diesel powered equipment must be fitted with or placed within constructed secondary containment.
- Jerry cans must be stored in a plastic spill containment tray / secondary containment tray with 125% capacity and be stored away from construction equipment traffic or large open areas, to avoid potential damages.
- Containment area must be located at least 30 m away from any watercourses.
- No equipment maintenance / repair is permitted on-site, unless during an emergency.
- Refueling of equipment must be completed via mobile refueling services.
- During refueling, oil/fuel absorbent pads must be wrapped and secured around all fittings to mitigate any spillage. Spill containment tray must be located underneath the refueling nozzle to capture drips and leaks, if any.
- All operators shall remain with the fuel nozzle while refueling and immediately shut off the source if spill occurs.
- The Contractor will prepare a Spill Response Plan prior to construction. Costs of the preparation of the spill response plan are incidental to the Contract. A Reference Spill Reponses Plan is included in Schedule 2.
- Spill Response Plan must be posted on the board or near the refueling facility.
- In the event of a spill, the Spill Response Procedures will be implemented.
- The Contractor must keep a stocked emergency spill kit at the site. The Environmental Monitor will inspect and confirm that a spill kit is onsite prior to commencement of culvert replacement works. Each spill kit will at a minimum have the following:
    - 3 - 10 m long absorbent spill booms
    - 50 - 16" x 20" Sorbent Pads (Oil, Gas & Diesel)
    - 6 - 48" x 3" Sorbent Socks (Oil, Gas & Diesel)
    - 4 -120" x 3" Sorbent Socks (Oil, Gas & Diesel)
    - 4 - 8" x 18"Sorbent Pillows (Oil, Gas & Diesel)
    - Nitrile Gloves
    - Hand Wipes
    - 2 - Disposable Respirators N958 HD
    - Hazmat Disposal Bags

- Operators will be held responsible to ensure that oil, grease or other deleterious substances do not enter any riparian and/or environmentally sensitive areas.

- Any spill of a substance toxic to aquatic life of reportable quantities will be immediately reported to the Provincial Emergency Program 24 hour phone line at 1-800-663-3456. The contractor will develop a spill response plan. A reference spill response plan is provided in Schedule 3, the Contractor shall establish and implement their own spill response plan concurrent with this contract.
- The contractor is wholly responsible for costs associated with clean-up of spills originating from their equipment or work practices.
- Call or submit a web application before you dig. BC One Call 1-800-474-6886.

5.8 Archaeological Resource Protection

- Complete archaeological assessment, if required, to ensure that the site is not located within or near an archeological site. There is always the possibility of encountering an archaeological or cultural resource when the project involves ground-disturbing activities.
- The Contractor must not collect or disturb artifacts.
- Immediately halt construction if the Contractor uncovers archaeological resources or black greasy soils containing shell fragments, or other suspect archeological or cultural resource.
- The Contractor will report to the EM immediately upon discovery of potential archaeological or cultural resources.
- The EM will notify the Client and Contract Administrator, who will initiate Contact with the Heritage Branch and First Nations whose traditional territory encompasses the project site.
- A professional archaeologist will have to assess the site and the contractor may be delayed in resumption of construction until the archaeological site has been appropriately assessed.

SCHEDULE 1
Contractor Environmental Orientation Record

ISL Environmental Management - Contractor Environmental Orientation Record

The Contractor Environmental Orientation Record (CEOR) shall be completed for all works involving an environmental component. The Environmental Monitor is responsible for ensuring that the environmental requirements of the work are reviewed with the Contractor before work is started, and that a record of the discussion is documented on the CEOR. The form must be signed by both the Environmental Monitor and the Contractor. By signing the CEOR, the Contractor indicates he/she has been advised of the environmental requirements of the project. The CEOR shall be filed with the Contract documents as required to confirm pay items, or to otherwise satisfy requirements of the contract.

	Date:		File No.
1	**Project Information**		
	Project Title		
	Project Description		
	Project Location		
2	**Contractor Information (if applicable)**		
	Company Name		
	Company Address		
	Site Contact/Representative Name		
	Tel. #	Fax #	E-mail

3	**Environmental Management Plan** Review the environmental issues and requirements of the work as specified in the Environmental Management Plan (EMP), Regulatory approvals or Best Management Practices (BMP)		
	Is there an EMP, CMP,BMP or Field Guide for the work?	❑ Yes	❑ NA
	Have the environmental requirements been reviewed with the Contractor and the Contractor's staff? (Use the checklist below to guide discussion)	❑ Yes	❑ NA

Environmental Issues	Environmental Management Plan Requirements	Discussed	NA
Fish and Aquatic - habitat alteration, disturbance or loss		❑	❑
Site isolation & Bypass		❑	❑
Instream footprint mitigation		❑	❑
Riparian footprint mitigation (Vegetation disturbance or removal and mitigation)		❑	❑
Noxious weed control		❑	❑
Wildlife and Bird - habitat alteration, disturbance or loss		❑	❑
Soil erosion/compaction Water quality - erosion and siltation		❑	❑
Disturbance to Heritage Resources/Archaeological Sites		❑	❑
Noise Concerns		❑	❑
Hazardous waste (garbage)		❑	❑

Environmental Issues	Environmental Protection Requirements	Discussed	NA
Air emissions/ dust generation/other		❑	❑
Generation and disposal of waste (litter, latrine)		❑	❑
Fuel and flammable storage		❑	❑
Fuel-Spill of Spill of hazardous substances		❑	❑
Generation and disposal of hazardous substances		❑	❑
Property Considerations		❑	❑
Do the tools and equipment meet the requirements?		❑	❑

	Permits and Approvals Information: Ensure the necessary environmental permits and approvals relating to the work have been obtained prior to starting work.		
	Are environmental notification, permits, licenses or approvals required?	❑ Yes	❑ NA
	List applicable regulatory requirements and permit reference numbers.		
	Have the permits, licenses and approvals obtained and/or checked?	❑ Yes	❑ NA
	Emergency Response Plan/Oil and Chemical Spill Response Plan		
	Has the Oil and Chemical Spill Response Plan been discussed?	❑ Yes	❑ NA
	Are there spill kits available on location?	❑ Yes	❑ NA
	Where are the spill kits located?	❑ Yes	❑ NA
	Does the contractor have an Emergency Response Plan? Has it been discussed?		
	Environmental Incident Reporting		
	Environmental Incident Reporting Procedures discussed?	❑ Yes	❑ NA

The undersigned has been briefed on the environmental requirements of the work as detailed above.

Signed: _____ Contractor Foreman Date: _____

Counter-signed: _____ Environmental Monitor Date: _____

Additional Comments:

_____

_____

_____

SCHEDULE 2
Reference Spill Response Procedures

INCIDENT

If a spill of fuel, oils, lubricants or other harmful substances occurs at the site, the following procedures will be implemented

Spill Response Steps

1. ENSURE SAFETY
2. STOP THE FLOW (when possible)
3. SECURE THE AREA
4. CONTAIN THE SPILL
5. NOTIFY/REPORT (PEP 1-800-663-3456)
6. CLEAN-UP

(Circumstances may dictate another sequence of events)

1. ENSURE SAFETY

- Ensure Personal, Public, and Environmental Safety
- Wear appropriate Personal Protective Equipment (PPE)
- Never rush in, always determine the product spilled before taking action
- Warn people in immediate vicinity
- Ensure no ignition sources if spill is of a flammable material

2. STOP THE FLOW (when possible)

- Act quickly to reduce the risk of environmental impacts
- Close valves, shut off pumps or plug holes/leaks, set containers upright
- Stop the flow of the spill at its source

3. SECURE THE AREA

- Limit access to spill area
- Prevent unauthorized entry onto site

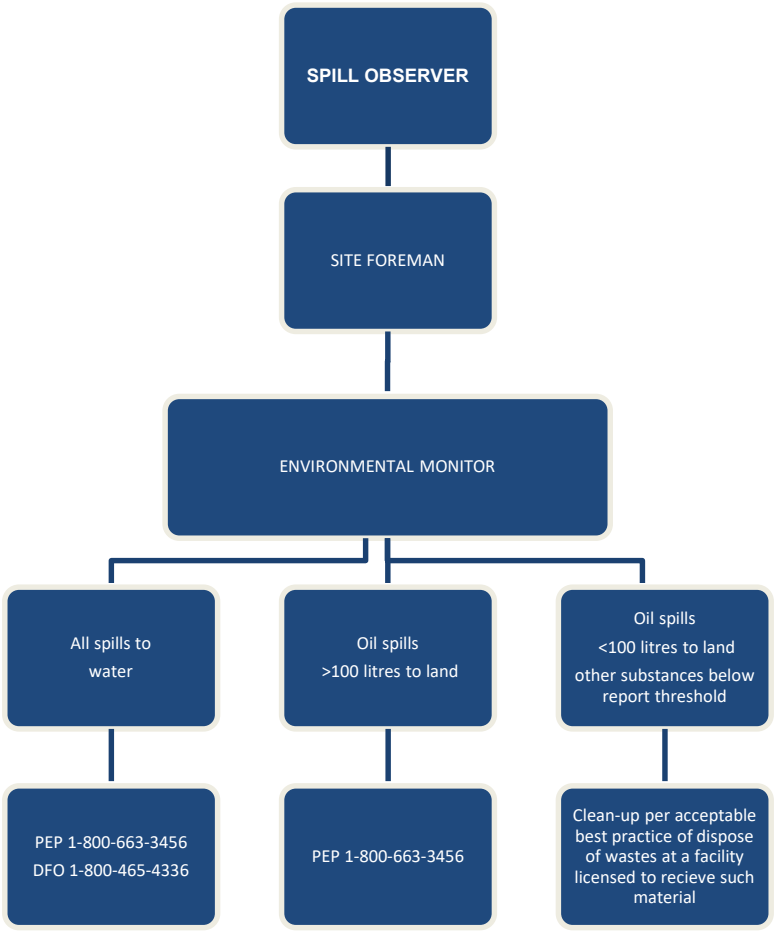
4. CONTAIN THE SPILL

- Block off and protect ditches, drains and culverts
- Prevent spilled material from entering drainage structures (ditches, culverts, drains)
- Use spill sorbent material to contain spill
- If necessary, use a dike, berm or any other method to prevent any discharge off site
- Make every effort to minimize contamination
- Contain as close to the source as possible

5. NOTIFY/REPORT

- Notify Site Supervisor and EM (or alternate) of incident (provide spill details)
- When necessary, the first external call should be made to (see spill reporting requirements):
- Provincial Emergency Program (PEP) 1-800-663-3456 (24 hours)
- Provide necessary spill details to other external agencies (see spill reporting requirements)

Spill Reporting Notification Chart



Reportable Spill Quantity List
List of externally reportable quantities for commonly used substances

Product	Quantity
Class 2.1 - flammable gas (e.g., propane)	10 kg or 10 min.
Class 2.2 - non flammable gas (e.g., SF6, CO_2)	10 kg or 10 min.
Class 3 - flammable liquids	100 litres
Class 8 - corrosive liquid acids and caustics (e.g., battery acid)	5 kg or litres
Class 9 - environmentally hazardous (e.g., PCB's, used ethylene glycol)	1 kg or litres
Oil & Waste Oil	100 litres
Other Substances (e.g., new antifreeze, power-wash water)	200 kg or litres
Pesticides & Herbicides	1 kg or litre

*****ALL SPILLS TO WATER ARE REPORTABLE*****

If in doubt as to whether or not to report a spill, err on the side of caution and report the spill.

SCHEDULE 3
Project Contact List

CONTACT	NAME	OFFICE #	CELL#	24 HOUR #
Contractor	TBD	TBD	TBD	TBD
Contractors Foreman	TBD	TBD	TBD	TBD
Contract Administrator	TBD	TBD	TBD	TBD
Engineer of Record	Erica Messam, P.Eng.	604.371.0091	-	-
Environmental Monitor (Environmental Scientist)	Olga Grunlund, BA, BC-CESCL	604.371.0091	604.307.1408	
Ministry of Forests, Lands and Natural Resource Operations	TBD	TBD	TBD	TBD
Fisheries and Oceans Canada (DFO)	**1-800-465-4336**			
RAPP Line Emergency	**1-877-952-7277**			
RAPP Line Non Emergency	**http://www.env.gov.bc.ca/cos/rapp/form.htm**			
Provincial Emergency Response Program	**1-800-663-3456**			