

Parks Canada Agency

Rocky Barachois Bridge Replacement Project No. 1845

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<u>SECTION</u>	<u>TITLE</u>	<u>PAGES</u>
<u>DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS</u>		
00 21 10	List of Drawings	4
<u>DIVISION 01 – GENERAL REQUIREMENTS</u>		
01 11 00	Summary of Work	9
01 14 00	Work Restrictions	2
01 25 20	Mobilization and Demobilization	1
01 29 10	Measurement and Payment	8
01 29 83	Payment Procedures for Testing Laboratory Services	1
01 31 19	Project Meetings	2
01 33 00	Submittal Procedures	5
01 35 29.06	Health and Safety	8
01 35 43	Environmental Procedures	8
01 45 00	Quality Control	3
01 52 00	Construction Facilities	4
01 54 30	Temporary Weigh Scales	2
01 55 26	Traffic Regulation	6
01 56 00	Temporary Barriers and Enclosures	3
01 61 00	Common Product Requirements	4
01 71 00	Examination and Preparation	2
01 74 11	Cleaning	2
01 74 21	Construction/Demolition Waste Management and Disposal	4
01 77 00	Closeout Procedures	2
01 78 00	Closeout Submittals	4
<u>DIVISION 02 – EXISTING CONDITIONS</u>		
02 41 16	Structure Demolition	6
<u>DIVISION 03 - CONCRETE</u>		
03 10 00	Concrete Forming and Accessories	4

<u>SECTION</u>	<u>TITLE</u>	<u>PAGES</u>
03 20 00	Concrete Reinforcing	5
03 30 00	Cast-in-Place Concrete	17
03 30 51	Concrete for Bridge Decks	1
 <u>DIVISION 05 - METALS</u>		
05 12 33	Structural Steel for Bridges	11
05 50 00	Metal Fabrications	4
 <u>DIVISION 07 – THERMAL AND MOISTURE PROTECTION</u>		
07 14 13	Hot Fluid-Applied Rubberized Asphalt Waterproofing	5
07 19 10	Concrete Coating	2
07 92 00	Concrete Joint Sealant	4
07 95 10	Expansion Joint System	4
 <u>DIVISION 09 - FINISHES</u>		
09 97 19	Steel Coating	9
 <u>DIVISION 31 - EARTHWORK</u>		
31 05 16	Aggregate Materials	4
31 09 16.01	Pile Installation Templates	3
31 09 17	Pile Tests	2
31 11 00	Clearing and Grubbing	3
31 22 13	Rough Grading	2
31 23 33.01	Excavating, Trenching and Backfilling	3
31 23 33.02	Foundation Excavation Bridge	3
31 24 13	Roadway Embankments	6
31 24 14	Fill Against Structure	2
31 32 19.01	Geotextile	3
31 37 00	Armour Rip-Rap	2

<u>SECTION</u>	<u>TITLE</u>	<u>PAGES</u>
31 37 20	Clear Stone	2
31 61 13	Pile Foundations, General Requirements	6
31 62 16.13	Steel H-Piles-Temporary Retaining Walls	7
31 62 16.16	Steel Pipe Piles	4

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 01 16	Removal of Existing Asphalt	2
32 11 16.01	Granular Sub-Base	5
32 11 23	Aggregate Base Courses	5
32 12 13.16	Asphalt Tack Coat	3
32 12 16	Asphalt Paving	8
32 12 18	Asphalt Concrete Paving of Bridge Decks	2
32 15 60	Roadway Dust Control	1
32 17 23	Painted Traffic Lines and Markings	5
32 91 21	Finish Grading & Soil Placement	4
32 92 19.16	Hydraulic Seeding	5
32 92 19.17	Dry Mulching	3
32 93 10	Planting of Trees, Shrubs & Groundcovers	4

DIVISION 33 - UTILITIES

33 42 13	Pipe Culverts	5
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DIVISION 34 - TRANSPORTATION

34 71 13.25	Steel W Beam Guide Rail	3
34 71 15	Metal Traffic Barriers and Metal Railings for Structures	4
34 80 00	Highway Signage	3

APPENDICES

Appendix A – Environmental Documents

Appendix B – Geotechnical Report

1. List of Drawings

<u>DWG. No.</u>	<u>TITLE</u>
<u>CIVIL</u>	
CO1	Existing Conditions and Removals Plan (Sheet 1 of 3)
CO2	Existing Conditions and Removals Plan (Sheet 2 of 3)
CO3	Existing Conditions and Removals Plan (Sheet 3 of 3)
CO4	New Route 430 Sta. 9+976 to 10+220
CO5	New Route 430 Sta. 10+220 to 10+460
CO6	New Route 430 Sta. 10+460 to 10+700
CO7	New Route 430 Sta. 10+700 to 10+812
CO8	New Signage and Pavement Marking Plan
CO9	Cross Sections (Sheet 1 of 4)
C10	Cross Sections (Sheet 2 of 4)
C11	Cross Sections (Sheet 3 of 4)
C12	Cross Sections (Sheet 4 of 4)
C13	Miscellaneous Sections and Details
C14	New Clearing Plan
<u>LANDSCAPING</u>	
L01	Existing Conditions and Removals Plan (Sheet 1 of 2)
L02	Existing Conditions and Removals Plan (Sheet 2 of 2)
L03	Landscape Grading Plan (Sheet 1 of 3)
L04	Landscape Grading Plan (Sheet 2 of 3)
L05	Landscape Grading Plan (Sheet 3 of 3)
L06	Landscape Finish Treatment Plan (Sheet 1 of 3)
L07	Landscape Finish Treatment Plan (Sheet 2 of 3)
L08	Landscape Finish Treatment Plan (Sheet 3 of 3)

DWG. No. **TITLE**

CONSTRUCTION PHASING

AG1	North Approach Grading Requirements General Arrangement
AG2	North Approach Grading Requirements Sections
AG3	South Approach Grading Requirements General Arrangement
AG4	South Approach Grading Requirements Sections
EP1	Girder Erection Phase 1 and Phase 2
EP2	Girder Erection Phase 3 and Phase 4
EP3	Existing Structure Sections and General Notes
EP4	Girder Erection Girder Transport Axle Loads and Configuration
EP5	Girder Erection Girder Lift Connection Locations and Crane Lift Information
EP6	Girder Erection Crane Mats

TEMPORARY WORKS

TW1	Temporary Retaining Wall Plan and Elevation
TW2	Temporary Retaining Wall Elevation, Sections and Details
TW3	Temporary Retaining Wall Details
TW4	Phasing for Abutment Construction

EXISTING CONDITIONS

EX1	Existing Bridge General Arrangement
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STRUCTURAL

S1	General Arrangement Sheet 1 of 2
S2	General Arrangement Sheet 2 of 2
S3	Abutment Plans
S4	Abutment Sections and Wingwall Elevations
S5	Abutment Sections and Details
S6	Wingwall Pilaster Details
S7	Box Girder Layout Plan and Sections
S8	Box Girder Sections and Details

DWG. No. TITLE

STRUCTURAL (CON'T)

S9	Girder Diaphragm D1 Sections and Details
S10	Bearing and Plinth Details
S11	Girder Splice and Gusset Details
S12	Girder Miscellaneous Details
S13	Girder Camber/Web Cut Diagrams
S14	Deck Plan and Deck Elevations
S15	Deck, Curb and Railing Sections and Details
S16	Miscellaneous Deck Details
S17	Bridge Excavation and Fill Quantities
S18	Abutment Reinforcing Elevation and Sections
S19	Abutment Reinforcing Sections
S20	North West Wingwall Reinforcing
S21	South West Wingwall Reinforcing
S22	South East Wingwall Reinforcing
S23	North East Wingwall Reinforcing
S24	Deck Reinforcing
S25	Borelogs Sheet 1 of 5
S26	Borelogs Sheet 2 of 5
S27	Borelogs Sheet 3 of 5
S28	Borelogs Sheet 4 of 5
S29	Borelogs Sheet 5 of 5

Part 1 General

1.1 PROJECT LOCATION

- .1 The project is located in Gros Morne National Park, Newfoundland and Labrador. The work is located on Highway 430 at the Rocky Barachois Bridge near Rocky Cove, approximately 20.5 km southeast of Rocky Harbour.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Parks Canada is preparing to replace the Rocky Barachois Bridge which includes realigning a section of Highway 430.
- .2 Work includes the construction of a new 42 meter single span twin steel trapezoidal box girder bridge complete with a composite 225 mm cast-in-place concrete deck crossing Rocky Barachois Brook. The new bridge includes crash-tested steel barriers. The bridge superstructure is founded on fully integral piled abutments, consisting of 406 mm diameter x 12.7 mm thick steel pipe piles supporting a reinforced concrete cap and cantilevered wingwalls along each edge of the abutment.
 - .1 The construction of the new bridge abutments shall be completed in a phased manner as indicated on the contract drawings. The dressing of the final slopes on the downstream (west) side shall occur after traffic is transferred to the new bridge and the demolition of the existing bridge is complete.
 - .2 The demolition design for the existing bridge is the responsibility of the Contractor. The Contractor shall submit drawings sealed by a Professional Engineer licensed to practice in the province of Newfoundland and Labrador. Submissions are subject to review and approval of Departmental Representative.
 - .3 The new bridge shall be constructed in a manner that results in an aesthetically pleasing structure. Care shall be taken when forming all exposed concrete surfaces.
- .3 Demolition work includes the removal of the existing bridge crossing including concrete girders, concrete deck, abutments and retaining walls, once the new bridge is open to traffic.
 - .1 Demolition design shall include all the access, safe removals, and mitigation measures required to complete the work in an environmentally friendly manner.
 - .2 All existing foundations shall be removed to a minimum depth of 1 metre below existing streambed. All materials shall be removed from site and disposed or recycled by an approved method.
- .4 Highway 430 work generally includes the realigning of approximately 830 metres of roadway to create the approaches to the new Rocky Barachois Bridge and the removals and reshaping of the existing roadway embankments. Other work includes:
 - .1 Construction phasing in order to provide 2 lanes of traffic during construction, including the phases where traffic is diverted onto the new alignment, demolition of the existing roadway and completion of the final alignment.
 - .2 Final landscape finishing of all construction slopes.
 - .3 All signage, including footings and posts, as shown on the Drawings.

- .4 Temporary traffic control during all phases of construction.
- .5 The above listed work is subject to the following constraints during construction:
 - .1 Work shall be in accordance with Basic Impact Analysis and accompanying documents completed for this project.
 - .1 In-water work will not be permitted from June 30 to September 30 when fish are migrating through the construction site.
 - .2 Clearing is not permitted during nesting season which is anticipated to be between May 30 and July 15.
 - .2 In-water work is limited to dressing of the new front and side slopes surrounding each new abutment and the demolition activities surrounding the removal of the existing bridge structure foundations and dressing of the final slopes.
 - .3 Two traffic lanes must remain open on the existing bridge crossing and approaches at all times throughout construction, except as noted below:
 - .1 During blending of new alignment to existing road on the approaches, short duration single lane closures are acceptable to locally complete the roadbed structure and paving.
 - .2 During delivery of equipment and materials, short duration single lane closures are acceptable with prior approval from the Departmental Representative.
 - .3 During erection of girders, short duration bridge closure and single lane closures are acceptable with prior approval from the Departmental Representative.
 - .4 Contractor to provide approved traffic control plan for all construction phases, including those times during approved single lane closures.
 - .4 Two traffic lanes must be open and operational on the new replacement bridge prior to commencing demolition operations of the existing bridge crossing.
 - .5 Construction activities shall not detrimentally impact the surrounding environment or the waterway and shall respect allowable windows for in water work.
- .6 The Contractor is responsible for the delineation of the construction zones and the existing highway.
- .7 All work to be carried out in accordance with applicable federal, provincial regulations for those agencies having jurisdiction for the work. The work is subject to the National Parks Act and Regulations, Canadian Environmental Protection Act, and the Code of Practice of the Department of Labour.
- .8 The Contractor must be aware that other construction work will be being performed at several different locations near the project site during the time frame of this contract. Of particular note is grading work of Highway 430 Realignment / Reconstruction presently under construction in the area of work under this project. The Contractor will not have access to the area of work south of Station 10+500 until after July 31, 2019. Contractor needs to coordinate work and successive work zones with other contractors. PCA shall not be held responsible or consider any claim(s) for delay or other reason due to other construction work in the area.

1.3 CONTRACT METHOD

- .1 Construct Work under combined unit price and lump sum items contract.

1.4 CODES AND STANDARDS

- .1 Perform work in accordance with National Parks Act, Code of Practice of the Department of Labour, as it pertains to Provincial traffic control requirements (Department of Transportation & Works) and any other code of federal, provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Materials and workmanship must conform to or exceed applicable standards of Canadian General Standards Board (CGSB), Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM) and other standards organizations.
- .3 Conform to latest revision at the date of Tender of any referenced standard as re-affirmed or revised to date of specification. Standards or codes not dated shall be deemed editions in force on date of tender advertisement.

1.5 SITE CONDITIONS

- .1 The Contractor will be responsible to visit the site and review existing site conditions.
- .2 Before submitting a bid, it is recommended that bidders visit the site to review and verify the form, nature and extent of the work, materials needed, the means of access and the temporary facilities required to perform the Work.
- .3 Directional orientation for the site being set as north being the direction of travel towards Rocky Harbour, south being the direction of travel towards Deer Lake, west being downstream direction for Rocky Barachois Brook and east being upstream direction for Rocky Barachois Brook.
- .4 Obtain prior permission from the Departmental Representative before carrying out such site inspection.
- .5 Contractors, bidders or those they invite to site are to review specification Section 01 35 29.06 – Health and Safety Requirements before visiting site. Take all appropriate safety measures for any visit to site, either before or after acceptance of bid.
- .6 Details of the existing structure are for the Contractor to determine in considering use with over-weight and non-conforming vehicles in carrying out work on this project and in the demolition of the structure.
- .7 For geotechnical and borehole information, refer to the report: Geotechnical Investigation, Geotechnical Investigation, Rocky Barachois Bridge Replacement, Gros Morne National Park, File No: 163545, dated August 31, 2017, prepared by Harbourside Geotechnical Consultants.

1.6 INTERPRETATION OF DOCUMENTS

- .1 Supplementary to the Order of Precedence article of the General Conditions of the Contract, the Division 01 Sections take precedence over the technical specification sections in other Divisions of the Specifications Manual.

1.7 TERM ENGINEER

- .1 Unless specifically stated otherwise, the term Engineer where used in the Specifications and on the Drawings shall mean the Departmental Representative as defined in the General Conditions of the Contract.

1.8 SITE SURVEY AND SETTING OUT WORK

- .1 Topographic survey used in the preparation of these Contract Documents was provided by Design Point Engineering and Surveying Ltd. Refer to Drawings for survey details and control points.
- .2 A georeferenced CAD file of the site will be provided to the Contractor for use in layout. Parks Canada assumes no responsibility for the accuracy of this information.
- .3 Contractor to carry out all layout. The Contractor is responsible for the layout of grade stakes at every construction stage. Establish and maintain stakes at 20 m stationing and placement of offsets at 20 m stations (top of backslope, toe of slope, subgrade, granulars, shoulders, etc.) on which is written chainage and centreline offset. All stakes to be removed at the completion of the work.
- .4 The Contractor shall assume full responsibility for and execute complete layout of work locations, lines and elevations indicated.
- .5 The Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.
- .6 The Contractor shall provide coordinates, elevations and dimensions in the field, as required by the Departmental Representative.

1.9 WORK WITHIN PARK BOUNDARIES

- .1 The project is within a national park and it is essential that lands remain as undisturbed as possible. The Contractor will be expected to use standards and methods beyond those for normal construction in order to protect the environment and ensure the aesthetics of the work. Contract limits shall be strictly adhered to and every precaution shall be taken to minimize environmental damage and disruption to vegetation, wildlife habitat, and structures or existing services, both on construction and storage sites.
 - .1 If any damage occurs during construction, the Contractor is responsible to bear the expense to immediately restore such damaged areas to the satisfaction of Departmental Representative.
 - .2 If Contractor fails to repair damage to the satisfaction of the Departmental Representative, the Departmental Representative may have repairs completed by others at the Contractor's expense.
 - .3 The Contractor shall ensure that contracted work meets the standards outlined in the contract specification and drawings.
 - .4 The Contractor shall ensure that no damage will be done to any existing utilities.
 - .5 All sources of aggregate and asphalt cement must be submitted to the Departmental Representative for approval at least two weeks prior to the start of any work.
 - .6 The Contractor is responsible to follow the Provincial requirements regarding the following:

- .1 Pit and Quarry Guidelines
- .2 Environmental Construction Practice Specifications
- .7 The Contractor will make arrangements with authorities or owners of private properties for quarrying and transporting materials and machinery over their properties and be responsible for obtaining and paying of fees.
- .8 Water extraction from within the Park boundaries is strictly forbidden. Water extraction may be permitted following detailed proposal submitted by the Contractor and subject to approval by the Departmental Representative.
- .9 Special move permits for over-weight and over-dimensional vehicles required to travel provincial highways must be secured by the Contractor and submitted to the Departmental Representative for review and approval prior to movement within Park boundaries.
- .10 Production of rock material for this project may be extracted from the Cod Knotts Quarry located in Gros Morne National Park provided all material meets the project specifications. Any existing crushed rock located in the quarry at the beginning of the project must be replaced upon completion of the project if used (what is on the ground now, has to be on the ground when the contractor leaves). No royalties or fees will be charged for use of the quarry. All work in the quarry will be in accordance with the Cod Knotts Quarry – Rock Extraction Plan. The contractor must co-operate with other contractors using the quarry in carrying out their respective works and carry out instructions from the Departmental Representative. Additional payments or schedule extensions due to work or scheduling conflicts with other contractors in the quarry will not be considered.

1.10 MAINTENANCE OF WORK DURING CONSTRUCTION

- .1 Maintain work during construction. Undertake continuous and effective maintenance work day by day, with adequate equipment and forces so that the roadway or structures are continuously kept in a condition satisfactory to the Departmental Representative.

1.11 WORK SCHEDULE

- .1 Provide to the Departmental Representative in writing and within 5 working days after Contract award, a detailed construction schedule and traffic control plan. The schedule shall show proposed work to be undertaken and anticipated completion dates for each category of work in the Unit Price Table and Lump Sum items.
 - .1 Construction schedule shall accommodate that work to the south of Station 10+500 cannot commence until after July 31, 2019.
 - .2 After receiving the Contractor's plan and prior to start of construction, a meeting involving Contractor, Departmental Representative and Parks Canada will be held at a place and time to be determined by the Departmental Representative. This meeting will review implications of the contract, design, schedule of work, methods of construction, environment protection methods and traffic control.
 - .3 The final completion date shall be November 30, 2019 for all work on this project.
 - .4 Work must be undertaken without environmental impact to Rocky Barachois Brook or Bonne Bay. In-water work will not be permitted from June 30 to September 30 when fish are migrating through the construction site.

- .5 Clearing is not permitted during nesting season which is anticipated to be between May 30 and July 15.
- .6 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.
- .7 No work will begin until the pre-construction meeting is held and the Environmental Protection Plan, Health and Safety Plan and Traffic Control Plan have been accepted by the Departmental Representative.
- .8 Following the pre-construction meeting and approval of the schedule, traffic control plan, environmental protection plan and occupational health and safety plan, the work will be so scheduled to meet the time restraints and have the project completed on time.

1.12 CONTRACTOR'S USE OF SITE

- .1 Use of site: for execution of work within roadway right of way and those areas specified by the Departmental Representative.
- .2 The Departmental Representative will specify the areas for work and storage.

1.13 SANITARY SERVICES

- .1 The Contractor shall provide and maintain sanitary facilities for the use of workers at locations specified by the Departmental Representative. Provision of sanitary facilities shall meet requirements of provincial government and municipal statutes and authorities.

1.14 PROJECT MEETINGS

- .1 Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
- .2 After receiving the Contractor's schedule, traffic control plan, health and safety hazard assessment, and environmental protection plan, and prior to start of construction, a meeting involving Contractor, Departmental Representative and Parks Canada will be held at a place and time to be determined by the Departmental Representative. This meeting will review implications of the contract, design, schedule of work, health and safety, methods of construction, environmental protection methods and traffic control.

1.15 DEPARTMENTAL REPRESENTATIVE

- .1 Departmental Representative will be assigned after contract award.

1.16 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.

- .7 Copy of approved work schedule.
- .8 Field test reports
- .9 Manufacturer's installation and application instructions.
- .10 Site specific Health and Safety Plan and other safety related documents.
- .11 Other documents as stipulated elsewhere in the Contract Documents.

1.17 ADDITIONAL DRAWINGS

- .1 Departmental Representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

1.18 MEASUREMENT FOR PAYMENT

- .1 Notify Departmental Representative sufficiently in advance of operations to permit required measurements for payment.

1.19 CUTTING AND PATCHING

- .1 Cut and patch as required to make work fit.
- .2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.

1.20 RELICS, ANTIQUES AND WILDLIFE HABITAT

- .1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as cornerstones and contents, animal nesting sites, commemorative plaques, inscribed tablets, and similar objects found during course of work.
- .2 Give immediate notice to Departmental Representative and await Departmental Representative's written instructions before proceeding with work in this area.
- .3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

1.21 NATIONAL PARKS ACT

- .1 For projects within boundaries of National Park, perform work in accordance with National Parks Act.

1.22 MEASUREMENT OF QUANTITIES

- .1 Linear: Items which are measured by metre or kilometer are to be measured along centreline of installation unless otherwise shown on plans.
- .2 Area:
 - .1 Longitudinal and transverse measurements for areas to be measured horizontally.
- .3 Mass:
 - .1 Term "tonne" shall mean 1000 kg.
 - .2 Materials which are specified for measurement by mass shall be weighed on approved scales. Units used to haul material being paid for by mass shall bear

legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.

.4 Time:

- .1 Unless otherwise provided for elsewhere or by written authority of the Departmental Representative, hourly rental of equipment will be measured in actual working time and necessary travelling time of equipment within limits of project at an all-inclusive rate. Equip each unit of mobile equipment with an approved device to register actual hours of operation. Devices which only measure hours of running of motor will not be accepted.

1.23 PERMITS/AUTHORITIES

- .1 The Contractor shall obtain, and pay for, permits from authorities as required for all operations and construction. He shall also comply with all pertinent regulations of all authorities having jurisdiction over the work. The Contractor shall provide copies of all permits to the Departmental Representative prior to starting the work. The Contractor shall be responsible for obtaining all applicable permits, inspections and approvals required and shall pay all changes in connection therewith.

1.24 EQUIPMENT RENTAL RATES

- .1 Upon written request, the Contractor will supply the Departmental Representative with a list of the rental equipment to be used on work beyond the scope of bid items. Equipment rental rates will be in accordance with current rates published by the Newfoundland and Labrador Department of Transportation and Works (NLDTW Specification Book Division 10).

1.25 PROTECTION

- .1 Store all materials and equipment to be incorporated into work to prevent damage by any means.
- .2 Repair and replace all materials or equipment damaged in transit or storage to the satisfaction of the Departmental Representative and at no cost to Crown.
- .3 Contractor will take adequate precautions to protect existing structures when operating tracked equipment. Contractor shall also take care as to not detrimentally surcharge new and existing bridge foundations during activities such as, but not limited to, pile driving, girder erection, and existing bridge demolition.
- .4 Exercise care so as not to obstruct or damage public or private property in the area.
- .5 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.

1.26 EXISTING SERVICES

- .1 Carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.

- .3 Submit Schedule to and obtain approval from Departmental Representative for any shut down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Record locations of maintained, re-routed and abandoned service lines.
- .6 Ensure that two (2) lanes of traffic are maintained throughout construction. Periods of reducing traffic to one lane with alternating two way traffic may be considered for short periods of time as outlined in the Project Specifications and / or subject to the approval of the Departmental Representative.
- .7 Ensure traffic is not unduly impeded, interrupted or endangered by execution or existence of work or plant.
- .8 Maintain existing signs at all times. When it is necessary to temporarily remove a sign, it shall be dismantled and re-established on a temporary post or stand set back from construction area. The work is considered to be incidental and no separate payment will be made for maintaining or moving signs.
- .9 Verify locations of any underground utilities.

Part 2 Products

Not Used

Part 3 Execution

Not Used

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS

- .1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
 - .1 The Contractor shall obtain clearance reports from all utilities and ensure lines are not disturbed during the duration of this project. The Contractor will be required to coordinate their work with utility companies and schedule the works accordingly.
- .2 Provide for personnel, pedestrian and vehicular traffic

1.5 SPECIAL REQUIREMENTS

- .1 Work outside of normal working hours will require 48 hours written notice to the Departmental Representative. There are no restrictions on working on nights, weekends or statutory holidays with the exception of Victoria Day weekend and Canada Day weekend. During these weekends, no work is permitted between noon on Friday and 7 AM Tuesday morning.
- .2 The maximum cumulative traffic delay through the limits of construction shall not exceed 10 minutes, unless otherwise noted or approved by the Departmental Representative.
- .3 Time work in-water in accordance with Basic Impact Analysis reports completed for the project and included in Appendix A. In-water work will not be permitted from June 30 to September 30 when fish are migrating through the construction site.
- .4 Clearing is not permitted during nesting season which is anticipated to be between May 30 and July 15. Approval from the Departmental Representative must be given prior to commencement of clearing operation.
- .5 Water extraction from within the Park boundaries is strictly forbidden. Water extraction may be permitted following detailed proposal submitted by the Contractor and subject to approval by Departmental Representative.

- .6 Time work in-water in accordance with Basic Impact Analysis report completed for the project and included in Appendix A.
- .7 Maintenance to vehicles and equipment is prohibited within the Park boundaries.
- .8 Blasting within the Park boundaries is not permitted without approval from the Departmental Representative.
- .9 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .10 Keep within limits of work and avenues of ingress and egress.
- .11 The Contractor will not have access to the area of work south of Station 10+500 until after July 31, 2019.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work

1.2 DESCRIPTION

- .1 Mobilization and Demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, offices, supplies and incidentals to and from the project sites.
- .2 For the purposes of mobilization and demobilization, “project site” means the bridge site location.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 GENERAL

- .1 This section covers the measurement of Work done for payment purposes.
- .2 The estimated quantities shown in the Unit Price Table are provided for the purposes of comparing proposals, and are not guaranteed to be final, accurate or complete. Payment to the Contractor will be based on actual quantities of work completed in accordance with the drawings and specifications.
- .3 There shall be no measurement or payment for Work carried out beyond the limits defined on the Drawings.
- .4 The total of all Unit Prices and Lump Sum payments shall constitute full compensation for the entire Work of the Contract, as shown, specified, and intended.
- .5 The Contractor will only be entitled to payment when prior written authorization has been received from the Departmental Representative for utilization and then only to the extent of the work authorized by the Departmental Representative.
- .6 The unit and lump sum prices for all items in the Unit Price Table and Lump Sum Table shall represent the full compensation for the work of the item and shall include the cost of furnishing all materials, labour, tools, and equipment necessary to complete the work in accordance with the Contract, the Drawings and Specifications, and shall cover all costs of surety. Each item shall include all necessary supervision, plant and services, and all operations and allowances customary and necessary to complete each item and the Contract as a whole, notwithstanding the fact that not every such necessary operation is mentioned or included specifically for measurement.
- .7 Unless specified otherwise, all materials necessary to complete the items listed in the Unit Price Table, Lump Sum Table and the finished Work shall be new materials supplied by the Contractor and the cost of such material is to be included in the Contractor's prices.
- .8 All measurements for progress payment purposes shall be taken jointly by the Contractor and the Departmental Representative.
- .9 Items which are measured by the meter shall be measured along centreline of installation unless otherwise indicated.
- .10 Longitudinal and transverse measurement shall be made on the actual flat or sloped surface.
- .11 In computing volumes of excavation, average end area method will be used unless otherwise directed by Departmental Representative.
- .12 All volume measurements refer to in-place measures unless specified otherwise.
- .13 Materials which are specified for measurement by mass shall be weighed on scales approved by Departmental Representative refer to Section 01 54 30 – Temporary Weigh Scales. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.
- .14 Overhaul will not be paid on this Contract.

1.2 ITEMS – LUMP SUM TABLE

1. Mobilization / Demobilization

.1 Unit of Measurement is Lump Sum

.2 50% of Lump Sum Contract Price for Mobilization and Demobilization to be paid when mobilization to site is complete. The remainder of the Lump Sum Price for Mobilization and Demobilization to be paid when work is complete and all materials, equipment, buildings, shops, offices, and other facilities have been removed from site and site cleaned and left in condition to the satisfaction of the Departmental Representative and all other Agencies having Jurisdiction.

2. Construction Facilities

.1 Unit of Measurement is Lump Sum

.2 This item includes the provision of construction facilities required to complete the project. This item includes:

- Provide and maintain adequate access to project site.
- Build and maintain temporary roads during period of Work.
- Upon completion of the Work, rehabilitate any temporary roads to the satisfaction of the Departmental Representative.
- Clean roads and parking areas where used by the Contractor or employees.
- Provide, erect and maintain project identification site signs, Safety and Instruction signs and notices.
- Provide sanitary facilities.
- Construction site trailer(s).
- Removal of temporary facilities from the site as directed by the Departmental Representative.

3. Structure Demolition

.1 Unit of Measurement is Lump Sum

.2 This item includes demolition of the existing bridge superstructure (deck, curbs, railings, asphalt, and girders) and the demolition of the existing foundations to 1 m below existing streambed. This item also includes excavation of all material of whatever nature encountered to access existing foundations for the purpose of demolition, excavation and preparation of stable (2:1) slopes for the placement of Armour Rip-Rap and water control.

4. Concrete Reinforcing Galvanized

.1 Unit of Measurement is Lump Sum

.2 This item includes supply and installation of galvanized reinforcing steel for Cast-In-Place Concrete as indicated and necessary for this work. Approximate galvanized steel reinforcing quantities are provided solely for information purposes and PCA makes no claims with respect to their accuracy. The Contractor shall review the drawings and is responsible to prepare their own quantities. The approximate reinforcing quantity is 49,400 kg (based on ungalvanized).

5. Structural Steel For Bridges

- .1 Unit of Measurement is Lump Sum
- .2 This item includes supply and erection of all girder components, including but not limited to: girders, diaphragms, bracing, field splices, bearing plates and anchor bolts at each abutment, studs, stiffeners, field and shop splices, coatings, site access, crane pads, etc. Also included in this item is the setting of the girder into its final position, the installation of anchor bolts and the full grouting of the anchor sleeves and bearing surfaces beneath the masonry plates.

6. Concrete Coating

- .1 Unit of Measurement is Lump Sum
- .2 This item includes preparation of surfaces, supply and installation of concrete coating system.

7. Foundation Excavation Bridge

- .1 Unit of Measurement is Lump Sum
- .2 This item includes all excavation regardless of type (unclassified) for the construction of the abutments and placement of Fill Against Structure and Armour Rip Rap as shown on the drawings, including the disposal of all material resulting from this operation.

8. Temporary Retaining Wall

- .1 Unit of Measurement is Lump Sum
- .2 This item includes supply, installation and removal of temporary retaining structure at the north abutment for the construction of the concrete abutment as shown and described in the Contract Documents. This item also includes supply, installation and removal of local temporary traffic guardrails and all components and incidental connections as noted. Excavation in constructing and to that shown on the drawings to allow for construction of the abutment is also included under this item. No compensation will be provided for waste cut off or extension of the retaining structures beyond the limits shown on the Contract Drawings.

9. Painted Traffic Lines and Markings

- .1 Unit of Measurement is Lump Sum
- .2 This item includes supply of all materials and application of all traffic lines and markings on the pavement for the approaches and bridge deck, as indicated on the drawings.

10. Other Items Not Included in the Unit Price Table

- .1 Unit of Measurement is Lump Sum
- .2 This item includes all other work considered incidental to the work and which are not specifically mentioned or accounted for in the Unit Price Table or other items in the Lump Sum Table, but are necessary to complete the work in accordance with the Contract, the Drawings, and Specifications. This item shall include but are not limited to the following; environmental protection procedures as depicted within Appendix A Environmental Documents, sedimentation and erosion control, project layout and surveying, weigh scales, traffic control, permits, cold weather protection and curing of materials and water control.

1.3 ITEMS – UNIT PRICE TABLE

1. Cast-In-Place Reinforced Concrete
 - .1 Unit of Measurement is Cubic Meter (m³)
 - .2 This item includes supply, formwork, placing, compacting and finishing of all concrete for the bridge abutments, wingwalls, pilasters, bridge deck (including curbs), approach slab, and approach road drain. This item shall also include concrete sealant for curb control joints as shown on the Contract Drawings. Measurement shall be based on Contract Drawings with no deduction for displacement by reinforcement.
2. Galvanized Armour Angles
 - .1 Unit of Measurement is Each
 - .2 This item includes shop drawings, supply and installation of the armour angle assembly at approach ends of approach slabs.
3. Galvanized Membrane Drains
 - .1 Unit of Measurement is Each
 - .2 This item includes shop drawings, supply and installation of membrane drains on the east side of the bridge deck.
4. Bridge Deck Waterproofing
 - .1 Unit of Measurement is Square Meter (m²)
 - .2 This item includes preparation of surfaces, supply and installation of waterproofing system on bridge deck and approach slabs as applied to the bridge deck and approach slabs and extending 80 millimetres vertically on each curb. Measurement shall be based on Contract Drawings.
5. Concrete Joint Sealant
 - .1 Unit of Measurement is Meter (m)
 - .2 This item includes supply and installation to complete Expansion Joint Type A and Type B as shown on the Contract Drawings.
6. Expansion Joint System
 - .1 Unit of Measurement is Meter (m)
 - .2 This item includes supply and installation to complete the expansion joint system where indicated in the Contract Drawings. The routing and cutting of the asphalt is also included in this item.
7. Clearing
 - .1 Unit of Measurement is Hectare (ha)
 - .2 This item includes cutting and disposal of all trees, brush, and vegetative growth from areas identified.
8. Grubbing
 - .1 Unit of Measurement is Hectare (ha)

- .2 This item includes the removal, separation of topsoil, stockpiling and off-site disposal of all stumps, roots, visible rock fragments greater than 0.25 m³, downed timber, embedded logs, humus and root mat from areas identified.
9. Rough Grading
- .1 Unit of Measurement is Square Meter (m²)
 - .2 This item includes excavation of limited depth of areas which are to be reshaped. Areas to be rough graded to be as noted on the drawings or as directed by the Departmental Representative.
10. Unclassified Excavation Roadway and Drainage
- .1 Unit of Measurement is Cubic Metre (m³)
 - .2 This item includes excavation of unclassified material after removal of grubbing and topsoil and for placement and compacting of approved fill (common and rock) from on-site sources to lines and elevations indicated. This item shall also include excavation for the removal of culverts which will not be replaced at the same location. Disposal of unsuitable and excess material is considered incidental to this item and will not be paid for separately.
11. Borrow (Common)
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, loading, transportation, placement and compacting of approved borrow material from areas off site, required for construction of embankments or for other portions of work, to lines and elevations indicated.
12. Fill Against Structure
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, placement and compaction of fill against abutments to lines and elevations indicated. Supply and installation of perforated pipe drain system as shown on the Contract Drawings are included under this item.
13. Armour Rip Rap
- .1 Unit of Measurement is Cubic Meter (m³)
 - .2 This item includes supply and placement where indicated. This item also includes the supply and installation of geotextile material beneath the armour rip rap. Measurement shall be based on Contract Drawings.
14. Clear Stone
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, placement and compaction of Clear Stone as indicated on the drawings and as directed by the Departmental Representative. This item also includes the supply and installation of geotextile material beneath the clear stone.
15. Steel Pipe Piles - Supply
- .1 Unit of Measurement is Meter (m)

- .2 This item includes supply of steel pipe piles for the new bridge integral abutments, incorporated into the finished work. This item includes: submittals; handling and storing; supply, fabrication and fastening of pile caps, driving shoes and splices.
16. Steel Pipe Piles - Install
- .1 Unit of Measurement is Meter (m)
 - .2 This item includes installation of steel pipe piles for the new bridge integral abutments, incorporated into the finished work. This item also includes PDA testing.
17. Asphalt Removal
- .1 Unit of Measurement is Square Meter (m²)
 - .2 This item includes cold-plane, cut, excavate, load, transport and dispose of asphalt concrete to the lines and elevations indicated on the drawings or as directed by the Departmental Representative.
18. Granular Sub-Base (Granular B)
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, haulage, placement and compaction of Granular B material to the limits and at the locations indicated on the drawings. There will be no payment for extra thickness of sub-base materials placed outside of the theoretical lines and grades as indicated on the drawings. Whenever in the opinion of the Departmental Representative there is extra thickness, the appropriate weight will be deducted.
19. Aggregate Base Course (Granular A)
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, haulage, placement and compaction of Granular A material to the limits and at the locations indicated on the drawings. There will be no payment for extra thickness of aggregate base materials placed outside of the theoretical lines and grades as indicated on the drawings. Whenever in the opinion of the Departmental Representative there is extra thickness, the appropriate weight will be deducted.
20. Asphalt Mix Type: Base Course
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, transportation of all materials including asphalt tack coat and asphalt binder; production, handling, preparation of surface, placing (including material transfer device), rolling and compaction of asphalt concrete Base Course.
- There will be no payment for extra thickness or extra width of asphalt placed outside of the theoretical lines and grades as indicated on the drawings. Whenever in the opinion of the Departmental Representative there is extra thickness or extra width, the appropriate weight will be deducted.
21. Asphalt Mix Type: Surface Course
- .1 Unit of Measurement is Tonne (t)
 - .2 This item includes supply, transportation of all materials including asphalt tack coat and asphalt binder; production, handling, preparation of surface, placing (including material transfer device), rolling and compaction of asphalt concrete Surface Course. This item

also includes keyed joints at each end of construction and isolated areas of patch paving throughout construction. This item also includes the paving of the bridge deck.

There will be no payment for extra thickness or extra width of asphalt placed outside of the theoretical lines and grades as indicated on the drawings. Whenever in the opinion of the Departmental Representative there is extra thickness or extra width, the appropriate weight will be deducted.

22. Hydraulic Seeding

- .1 Unit of Measurement is Square Meter (m²)
- .2 This item includes supply of all materials, preparation of surface, application and maintenance to areas identified.

23. Dry Mulch

- .1 Unit of Measurement is Square Meter (m²)
- .2 This item includes supply of all materials, preparation of surface, application and maintenance to areas identified.

24. CSP – 600 mm diameter

- .1 Unit of Measurement is Meter (m)
- .2 This item includes supply of pipe, complete with fittings, and placement. Also included under this item is excavation required to complete installation.

25. HDPE Pipe – 600 mm diameter

- .1 Unit of Measurement is Meter (m)
- .2 This item includes supply of pipe, complete with fittings, and placement. Also included under this item is excavation required to complete installation.

26. Steel W-Beam Guide Rail – Bridge Approach

- .1 Unit of Measurement is Meter (m)
- .2 This item includes supply of all materials including Michigan Shoes, channel and reflectors, installation, backfilling, compaction, disposal of excess material and reinstatement of disturbed surfaces.

27. Steel W-Beam Guide Rail

- .1 Unit of Measurement is Meter (m)
- .2 This item includes supply of all materials including reflectors, installation, backfilling, compaction, disposal of excess material and reinstatement of disturbed surfaces. Measurement shall be based on linear measure of the completed sections, end to end (including buried sections).

28. Steel W-Beam Guide Rail Remove

- .1 Unit of Measurement is Meter (m)
- .2 This item includes removal, salvaging of designated components, transporting, unloading and neatly stacking, backfilling, compaction and reinstatement of disturbed surfaces and disposal of all materials. Measurement shall be based on linear measure of the removed sections, end to end, regardless of the number of rails between individual posts.

29. Galvanized Steel Barrier and Metal Railings for Structures

- .1 Unit of Measurement is Meter (m)
- .2 This item includes supply and installation as indicated and necessary for this work. Measurement shall be based on Contract Drawings.

30. to 40. Sign and Signpost Installation

- .1 Unit of Measurement is Each
- .2 This item includes supply and installation as indicated. Work considered incidental to this item are the removal of existing signs and posts being replaced including filling of holes and reinstatement of disturbed surfaces.

41. Landscape Treatment 1

- .1 Unit of Measurement is Square Meter (m²)
- .2 This item includes placement of stockpiled organic material to depth indicated, supply and planting of trees, including planting soil, maintenance and guarantee. Hydro-seeding of Landscape Treatment 1 covered under Hydraulic Seeding.

42. Landscape Treatment 2

- .1 Unit of Measurement is Square Meter (m²)
- .2 This item includes placement of stockpiled organic material to depth indicated, supply and planting of trees/scrubs, including planting soil, maintenance and guarantee. Hydro-seeding of Landscape Treatment 2 covered under Hydraulic Seeding.

43. Landscape Treatment 3

- .1 Unit of Measurement is Square Meter (m²)
- .2 This item includes placement of stockpiled organic material. Hydro-seeding of Landscape Treatment 3 covered under Hydraulic Seeding.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections.

1.2 APPOINTMENT AND PAYMENT

- .1 Departmental Representative will appoint and pay for services of testing laboratory except as follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
 - .6 Additional tests specified as follows in the following paragraph.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative 48 hours minimum in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 4 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: to be in GANTT Chart format.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .7 PCA provided products.
 - .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .11 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .12 Appointment of inspection and testing agencies or firms.
 - .13 Insurances, transcript of policies.

1.2 PROGRESS MEETINGS

- .1 During course of Work, Departmental Representative will schedule progress meetings monthly.
- .2 Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.
- .3 Departmental Representative will notify parties minimum 4 days prior to meetings.
- .4 Departmental Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 days after meeting.
- .5 Progress agenda to include the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of Work progress since previous meeting.
- .3 Field observations, problems, conflicts.
- .4 Problems which impede construction schedule.
- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Refer to Technical Specifications which reference "SUBMITTALS" under PART 1 – GENERAL of each section.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals in electronic (PDF) format 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 co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .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.

1.3 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 Submit drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
 - .1 When requested by the Departmental Representative, the Contractor shall provide CV and proof of Errors and Omissions insurance (coverage of at least 2 million dollars) of the professional engineer who will be stamping drawings.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment,

indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow ten (10) business days, unless otherwise noted, for Departmental Representative's review of each submission
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 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.
- .9 After Departmental Representative's review, distribute copies.

- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accordance with specified requirements.
 - .2 Testing must have been within 2 years of date of contract award for project, unless otherwise noted.
- .13 Submit electronic copy of certificates for requirements requested in specification Sections and as directed by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copy of manufacturer's instructions for requirements requested in specification Sections unless otherwise directed by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Documentation of the testing and verification actions by manufacturer's representative to confirm compliance with manufacturer's standards and instructions.
- .16 Delete information not applicable to project.
- .17 Supplement standard information to provide details applicable to project.
- .18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .19 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of

responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.4 SAMPLES

- .1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's site office.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.
- .3 Submit Certificates of Conformance to the Departmental Representative, stating that the component(s) has been installed in conformance with the approved shop drawings. Certificate of Conformance to bear the seal and signature of a Professional Engineer licensed in the province of Newfoundland and Labrador.
- .4 Certificates of Conformance required for, but not limited to, the following:
 - .1 All components where shop drawings are required (unless otherwise directed by the Departmental Representative).
 - .2 Dry film thickness of each coating of paint.
 - .3 As specified elsewhere in the Contract Documents.

1.6 PROCEDURES

- .1 Provide procedures required as specified in the Contract documents or as directed by the Departmental Representative.

1.7 OTHER SUBMISSIONS

- .1 Provide a construction schedule and cash flow forecasts updated every month.
- .2 Provide all other submissions as required by law and the Contract documents.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .2 Province of Newfoundland and Labrador
 - .1 Occupational Health and Safety Act
 - .2 Occupational Health and Safety Regulations made pursuant to the Act
 - .3 Department of Transportation and Works (NLDTW) Traffic Control Manual (TCM).
- .3 Part 8 of the National Building Code
- .4 Municipal by-laws and ordinances.

1.2 DEFINITIONS

- .1 Competent Person: means a person who is:
 - .1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace;
 - .2 Knowledgeable about the provisions of occupational health and safety statutes and regulations that apply to the Work; and
 - .3 Knowledgeable about potential or actual danger to health and safety associated with the Work.
- .2 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.
- .3 Work site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit site specific Health and Safety Plan: within 10 days of notification of Bid Acceptance and prior to commencement of work.
- .3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments. Revise plan as appropriate and resubmit within ten (10) working days after receipt of comments.
- .4 Submit revisions and updates made to the Contractor's Health and Safety plan during the course of the Work.
- .5 Submit records of Contractor's Health and Safety meetings when requested.

- .6 Submit Construction Safety Checklists after completion.
- .7 Submit copies of reports of directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .8 Submit copies of incident and accident reports.
- .9 Submit WHMIS MSDS – Material Safety Data Sheets.
- .10 Submit proof of Workers' Compensation Coverage through submission of Letter of Good Standing. Contractor must maintain good standing throughout the duration of the contract.
- .11 Contractor's responsibility for Health and Safety is not relieved in any way by the Department Representative's review or lack of review of these submittals.

1.4 COMPLIANCE REQUIREMENTS

- .1 Comply with the Occupational Health and Safety Act for the Province of Newfoundland and Labrador, and the Regulations made pursuant to the Act.
- .2 Observe and enforce construction safety measures required by:
 - .1 2015 National Building Code of Canada, Part 8;
 - .2 Provincial Worker's Compensation Board;
 - .3 Municipal by-laws and ordinances.
- .3 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
- .4 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Departmental Representative upon request.
- .5 Medical Surveillance: Where prescribed by legislation or regulations, obtain and maintain worker medical surveillance documentation.

1.5 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons and environment adjacent to the site to the extent that they may be affected by the conduct of Work.
- .2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 SITE CONTROL AND ACCESS

- .1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop non-authorized persons from circulating within construction areas and remove from site.
- .2 Implement procedures for granting permission to enter onto work site to all persons who require access. Procedures to include the provision of a site safety orientation session.

- .3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, boarding and temporary lighting as required. See Section 01 56 00 – Temporary Barriers and Enclosures for minimum type of barriers acceptable.
- .4 Erect signage at entry points and at other strategic locations indicating restricted access and conditions of access. Signage must be professionally made in both official languages or by use of well understood graphic symbols.
- .5 Secure work site against entry when inactive or unoccupied and to protect persons against harm. Provide security guard as deemed necessary to protect site against entry.
- .6 Ensure persons granted access is fitted and wear appropriate personnel protective equipment (PPE). Be responsible for the provision of such PPE to persons who require access to conduct work or perform inspections.

1.7 PROTECTION

- .1 Provide temporary facilities for protection and safe passage of vehicular traffic around and adjacent to work site.
- .2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.
- .3 Carry out work placing emphasis on health and safety of public, site personnel and protection of the environment over cost and schedule consideration for work.
- .4 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.8 FILING OF NOTICE

- .1 File Notice of Project and other Notices with Provincial authorities prior to commencement of work.

1.9 PERMITS

- .1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.
- .2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain Departmental Representative's approval to proceed prior to carrying out that portion of work.
- .3 Post all permits on site. Submit copies to Departmental Representative.

1.10 HAZARD ASSESSMENTS

- .1 Implement and carry out a health and safety hazard assessment program as part of the work. Program to include:
 - .1 Initial hazard assessment carried out immediately upon notification of contract award and prior to commencement of work.
 - .2 On-going hazard assessments performed during the progress of work identifying new or potential health risks and safety hazards not previously known. As a minimum hazard assessments shall be carried out when:

- .1 New sub-trade work, new subcontractor(s) or new workers arrive at the site to commence another portion of the work.
- .2 The scope of work has been changed by Change Order.
- .3 Potential hazard or weakness in current health and safety practices are identified by Departmental Representative or by an authorized safety representative.
- .3 Hazard assessments to be project and site-specific, based on review of contract documents, site and weather conditions.
- .4 Each hazard assessment to be made in writing. Keep copies of all assessments on site for duration of work. Upon request, make available to Departmental Representative for inspection.

1.11 PROJECT/SITE CONDITIONS

- .1 The following are known or potential project related safety hazards at site:
 - .1 Running water, potential heavy flows.
 - .2 Highway traffic.
 - .3 Working over water.
 - .4 Heavy equipment.
 - .5 Slope stability and temporary shoring.
 - .6 Wildlife.
 - .7 Working at heights.
 - .8 Working overhead.
 - .9 Suspended scaffolding.
 - .10 Demolition.
 - .11 Exposure.
 - .12 Remote site.
- .2 Above lists shall not be construed as being complete and inclusive of safety and health hazards encountered as a result of Contractor's operations during the course of work.
- .3 Include above items into the hazard assessment program specified herein.

1.12 SAFETY MEETINGS

- .1 Prior to commencement of work attend health and safety meeting conducted by Departmental Representative. Departmental Representative will advise of time and location. Ensure attendance of:
 - .1 Superintendent of Work.
 - .2 Designated Health and Safety Site Representative
 - .3 Subcontractors.
- .2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.
- .3 Keep documents on site.

1.13 HEALTH AND SAFETY PLAN

- .1 Develop written site-specific Project Health and Safety Plan, based on hazard assessments, prior to commencement of work. Submit plan to Departmental Representative within 10 calendar days of Contract Award date.
- .2 Health and Safety Plan shall contain the following components:
 - .1 List of health risks and safety hazards identified by hazard assessments.
 - .2 Control measures used to mitigate risks and hazards identified.
 - .3 On-site Contingency and Emergency Response Plan as specified below.
 - .4 On-site Communications Plan as specified below.
 - .5 Name of Contractor's designated Health and Safety Site Representative and information showing proof of their competence and reporting relationship in Contractor's company.
 - .6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.
 - .7 On-site Contingency and Emergency Response Plan shall include:
 - .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
 - .2 Evacuation plan: site layouts showing escape routes, marshalling areas. Details of alarm notification methods, fire drills, location of firefighting equipment and other related data.
 - .3 Name, duties and responsibilities of persons designated as Emergency Warden(s) and deputies.
 - .4 Emergency Contacts: name and telephone number of officials from Contractor, Sub-Contractors, federal and provincial departments having jurisdiction, local emergency resource organization.
 - .5 Harmonize plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PCA and Facility Management contacts.
 - .8 On-site Communications Plan:
 - .1 Procedures for sharing of work related safety information to workers and Sub-Contractors, including emergency and evacuation measures.
 - .2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.
 - .9 Address all activities of the Work including those of Sub-Contractors.
 - .10 Review and update Health and Safety Plan regularly during the Work. Update as conditions warrant addressing additional health risks and safety hazards, such as whenever new trade or Sub-Contractors arrive at Work site.
 - .11 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Health and Safety Plan with correction of deficiencies or concerns.
 - .12 Post copy of the Health and Safety Plan, and updates, prominently at Work site.

1.14 SAFETY SUPERVISION AND INSPECTIONS

- .1 Designate Health and Safety Site Representative to be present on site at all times during work, responsible for supervising health and safety and conducting safety inspections of work site.
- .2 Health and Safety Representative shall be assigned the responsibility and authority to:
 - .1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work.
 - .2 Conduct site safety orientation session to persons granted access to the Work site.
 - .3 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work site.
 - .4 Authority to stop and start work as deemed necessary for reasons of health and safety.
- .3 Conduct regularly scheduled safety inspections of work site as follows:
 - .1 Informal Inspections: carry out a minimum bi-weekly basis. Note deficiencies and remedial action taken in a log book or diary.
 - .2 Formal Inspections: carry out on a minimum monthly basis. Use standardized safety checklist forms. Prepare written report for each formal inspection. Document deficiencies, remedial action needed and assign responsibility for rectification to appropriate subcontractor or worker.
- .4 Cooperate with Facility's Health and Safety Site Coordinator responsible for the entire site or facility, should one be designated by Departmental Representative.
- .5 Maintain safety inspection documentation on site

1.15 TRAINING

- .1 Ensure that workers, subcontractors and other authorized persons granted access to site are effectively trained in occupational health and safety and practices pertinent to their assigned tasks.
- .2 Maintain employee records and evidence of training received.
- .3 Make training records readily available for review by Departmental Representative upon request.
- .4 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of Work immediately stop work and advise Department Representative verbally and in writing.
- .5 Follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative.

1.16 MINIMUM SITE SAFETY RULES

- .1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons granted access:

- .1 Wear personnel protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear (and eye protection where appropriate).
 - .2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.
 - .3 Maintain site and storage areas in tidy condition free of hazards causing injury.
 - .4 Obey warning signs and safety tags.
- .2 Brief workers on site safety rules, and on the disciplinary measures to be taken for violation or non-compliance of such rules. Post such information on site.

1.17 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative will stop Work if non-compliance of health and safety regulations are not corrected in a timely manner.

1.18 INCIDENT REPORTING

- .1 Investigate and immediately report to Departmental Representative incidents that:
 - .1 Require reporting to Provincial Department of Occupational Safety and Health, Workers' Compensation Board or to other regulatory agency.
 - .2 Medical aid injuries.
 - .3 Property damage in excess of \$10,000.00,
 - .4 Interruption to Facility operations resulting in an operational loss to a Federal department or client in excess of \$5,000.00,
 - .5 Required notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable regulations.
- .2 Submit report in writing.

1.19 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information Systems (WHMIS).
- .2 Keep MSDS data sheets on site. Provide copies of all data sheets to Departmental Representative upon receipt of materials on site.
- .3 Post all MSDS data sheets on site, in a common area, visible to workers.

1.20 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.21 POWDER ACTUATED DEVICES

- .1 Use powder actuated fastening devices only after receipt of written permission from Departmental Representative.

1.22 CONFINED SPACES

- .1 Abide by occupational health and safety regulations regarding work in confined spaces.
- .2 Safely for Inspectors:
 - .1 Provide PPE and training to Departmental Representative and other persons who require entry into confined spaces to perform inspections.
 - .2 Be responsible for efficacy of equipment and safety of persons during their entry and occupancy in the confined space.

1.23 POSTING OF DOCUMENTS

- .1 Post documents indicated herein and as required by Authority having jurisdiction.

1.24 RECORDS ON SITE

- .1 Ensure applicable items, articles, notices and orders are posted in a conspicuous location on Work site in accordance with Acts and Regulations of Province of Newfoundland and Labrador.
- .2 Post other documents as specified herein, including:
 - .1 Site specific Health and Safety Plan.
 - .2 WHMIS data sheets.
 - .3 Incident reports.
 - .4 Tool box and safety meeting minutes.
- .3 Make available to Departmental Representative, or authorized safety representative, for inspection upon request.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 RELATED SECTIONS

- .1 Section 01 74 21 – Construction / Demolition Waste Management and Disposal

1.3 REFERENCES

- .1 National Parks Act.
- .2 Canadian Environmental Protection Act.
- .3 Newfoundland and Labrador Provincial Standards.
- .4 Guidelines for Protection of Freshwater Fish Habitat, DFO Canada.
- .5 Basic Impact Analysis (BIA) Rocky Barachois Bridge Replacement, Parks Canada.
- .6 Parks Canada National Best Management Practices Roadway, Highway, Parkway and Related Infrastructure.
- .7 Geotechnical Investigation, Rocky Barachois Bridge Replacement, Gros Morne National Park, File No: 163545, dated August 31, 2017, prepared by Harbourside Geotechnical Consultants.

1.4 ENVIRONMENTAL PERFORMANCE

- .1 The Contractor shall comply with all mitigative measures, terms and conditions outlined in the attached Basic Impact Analysis (BIA) Rocky Barachois Bridge Replacement, Parks Canada and Parks Canada National Best Management Practices Roadway, Highway, Parkway and Related Infrastructure. The BIA and BMP are attached as Appendix A of this specification.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 An Environmental Briefing will be held prior to work commencing at the site, which will outline environmental factors to be considered during the work. It is mandatory that all current staff of the Contractor attend this meeting with the Departmental Representative and Environmental Protection Officer (EPO).
- .3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Environmental Protection Plan: include as applicable:

- .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
- .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
- .3 Names and qualifications of persons responsible for training site personnel.
- .4 Descriptions of Environmental Protection Personnel Training Program.
- .5 Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .7 Spill Contingency Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .8 Non-Hazardous Solid Waste Disposal Plan identifying methods and locations for solid waste disposal including clearing debris and recycling of decommissioned bridge materials.
- .9 Air Pollution Control Plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .10 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .11 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.6 FIRES

- .1 Fires and burning of rubbish on site is not permitted.
- .2 The Contractor is required to comply with the Fire Protection Regulations of the National Parks Act.
- .3 In accordance with these Regulations, the Park Superintendent may restrict activities, or access to work areas, in the interest of fire prevention.
- .4 The Contractor's equipment must be in proper working condition, and be used in such a manner as to minimize the potential for ignition of vegetation.
- .5 Vehicles and stationary equipment must be equipped with fire suppression equipment such as an operable fire extinguisher.

- .6 If storage and/or operation of in-Park equipment during a high fire hazard season is of concern to the Park, the Contractor may be required to prepare and implement a Fire Suppression Contingency Plan.
- .7 The Departmental Representative and the Duty Warden of the Park must be contacted immediately in the event of a fire. The Contractor is held responsible to make all reasonable efforts to extinguish any fires on the site.

1.7 DRAINAGE

- .1 As part of the Environmental Protection Plan, the Contractor shall provide an Erosion and Sediment Control Plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Do not pump water containing suspended materials into waterways, or drainage systems.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Provincial authority requirements.

1.8 SITE CLEARING AND PLANT PROTECTION

- .1 Restrict vegetation removal to areas indicated or designated by Departmental Representative.
- .2 Sensitive areas should be cleared in a manner which will minimize disturbance to surface vegetation and soils. Areas such as stream crossings should only be cleared immediately prior to construction using light equipment.
- .3 Bulldozers, graders, and other clearing and grubbing equipment should not be operated outside of designated clearing boundaries and should have a restricted turning radius.
- .4 Vegetation and topsoil should not be removed to obtain fill for road construction purposes.
- .5 Whenever possible, organic debris and topsoil removed during grading operations should be stored for use during site restoration. Such stockpiles should be located well away from any stream or water body and should be covered with coarse material to minimize wind and water erosion.
- .6 Should cultural resources artifacts be unearthed or discovered during project excavation, work in that area should be stopped and the Departmental Representative contacted immediately.
- .7 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .8 Minimize stripping of topsoil and vegetation.

1.9 SITE SET-UP AND USE

- .1 All site activities related to construction are to be confined within the defined project boundaries.

- .2 Office trailer(s) will be permitted to be located within the boundaries of Gros Morne National Park. Location is subject to approval of the Departmental Representative.
- .3 Work sites will be equipped with appropriate and properly maintained sanitary facilities.
- .4 Garbage must be collected and removed daily from the worksite to keep the site sanitary and to prevent unwanted interactions with Park fauna (e.g. bears). All material must be removed, transported and disposed of in accordance with existing provincial-municipal and Park solid waste disposal guidelines, project waste management plan and/or regulations.
- .5 Temporary storage parking areas, and turn-a-round facilities for contractor-related equipment and vehicles will be limited to those areas agreed to and designated by the Departmental Representative.
- .6 To reduce potential negative impacts on Park fauna, noise control measures, such as properly functioning mufflers on equipment, must be in place.
- .7 Littering is prohibited.
- .8 Water extraction from within the Park boundaries is strictly forbidden. Water extraction may be permitted following detailed proposal submitted by the Contractor and subject to approval by Department Representative.

1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste material on site. Remove all garbage from site daily.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.11 WORK ADJACENT TO WATERWAYS

- .1 In-water work will not be permitted from June 30 to September 30 when fish are migrating through the construction site.
- .2 Do not operate construction equipment in waterways.
- .3 All work is to be done in the dry. Environmental controls required to separate the work from the waterway is the responsibility of the Contractor.
- .4 Existing abutments are to be removed to 1 meter below the existing riverbed. All work is to be carried out with siltation control which separates the work area from the watercourse. The method of siltation control shall be provided as part of the Erosion and Sediment Control Plan.
- .5 No fresh concrete, lime, cement, or other construction materials or debris is to enter the watercourse.
- .6 All heavy equipment to be used on the project site is to be cleaned of mud, soil or debris prior to being brought to the site, in good working order, without leaks of fuel, oil, grease or lubricants.
- .7 Fueling of equipment must not take place within 100 m of a watercourse.
- .8 The movements of fish through the project site will be unimpeded at all times.
- .9 Contractor is to have a copy of the environmental assessment (Basic Impact Analysis (BIA) Rocky Barachois Bridge Replacement), Environmental Protection Plan and all applicable permits at the project site at all times.

- .10 Do not use waterway beds for borrow of material.
- .11 No excavated fill, waste material or debris from the removal of the existing bridge structure is to enter the watercourse.
- .12 Do not clean or drain equipment in waterways.
- .13 Blasting is prohibited.
- .14 Temporary diversion ditches, approved by the Departmental Representative are to be plastic lined.
- .15 Temporary storage sites for debris and soil generated from clearing operations should be deposited away from watercourses, should be surrounded by a natural vegetative buffer, should be screened from the road and should be selected by the Departmental Representative.
- .16 All temporary structures, piles, falseworks and debris are to be completely removed from the waterway.
- .17 Dredged material is not to re-enter the waterway.
- .18 Design and construct temporary crossings to minimize erosion to waterways.
- .19 Do not skid logs or construction materials across waterways.

1.12 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.13 EARTH MOVEMENT

- .1 Clearing and grubbing of project site is to be kept to a minimum.
- .2 Where engineering requirements can be met, excavated materials from this project must be used for backfilling.
- .3 There are no borrow areas available in the Park.
- .4 All surplus excavated material must be removed from the Park as soon as possible and disposed of at an approved location and in an approved manner.
- .5 Any proposed sources of borrow material shall be approved by the Departmental Representative prior to start-up.
- .6 When vegetation must be removed, then the extent and duration of exposure should be kept to a minimum. Plan the phases of development so that only areas which are actively being developed are exposed.
- .7 Topsoil from excavated sections shall be stockpiled for subsequent application to side slopes requiring revegetation. Steep slopes on stockpiles should be avoided in order to prevent erosion.

- .8 Sediment traps, basins, or ponds, whether temporary or permanent, shall be installed before construction begins on the rest of the site.
- .9 Dust control measure will be necessary, especially when asphalt is removed. The use of chemical dust control agents must be pre-approved by the Departmental Representative.
- .10 Where there is potential for severe erosion and/or downstream siltation the Contractor shall cover excavations during major precipitation events as directed by Departmental Representative.

1.14 EROSION AND SEDIMENTATION CONTROL

- .1 Appropriate preventative controls shall be in place at all times during construction to prevent undue erosion and sedimentation. As part of the Environmental Protection Plan, the Contractor is required to provide to the Departmental Representative seven days before start-up an Erosion and Sedimentation Control Plan. Such a plan shall incorporate necessary silt fences, silt / sediment traps, plastic lined trenches and ditches, temporary culverts or diversions as approved by the Departmental Representative
- .2 Backfilled slopes shall be mechanically compacted and grades should be consistent with the prevailing down-slope grade. Exposed soils should be immediately stabilized against erosion by covering with seed and hay mulch, clean rock, gravel or other suitable materials. Hydroseeding operations with approved seed mix will be carried out, as directed by Departmental Representative. All environmental controls must be monitored on a daily basis and following precipitation events. Any required maintenance or remediation must be done immediately.

1.15 HAZARDOUS MATERIALS

- .1 As part of the Environmental Protection Plan, the Contractor must submit a Fuel and Hazardous Materials Management and Spill Contingency Plan.
- .2 The management of fuels, lubricants and chemicals must meet with the requirements of the Newfoundland and Labrador Dangerous Goods and Hazardous Waste Management Criteria and all other appropriate provincial and federal regulations to include but not be limited to the following:
 - .1 Temporary fuel storage sites are to be located a minimum 200 m from any watercourse.
 - .2 Fuel storage containers must be accompanied by impermeable structures that would provide containment of 125% of the container capacity in the event of a leak or spill.
 - .3 Fueling and lubricating of equipment cannot be done closer than 100 m to any watercourse.
 - .4 All refuelling and lubricating operations should employ protection measures such as drip pans, to reduce the potential for escape of petroleum products to the environment.
- .3 No material toxic to fish or any aquatic life shall be permitted to enter any stream, river, or lake. This shall include, but not be limited to lubricants, fuels, testing fluids, insecticides, detergents, herbicides, cement, lime or concrete.
- .4 The Departmental Representative and the Park Warden must be immediately contacted after a spill of more than 10 L of fuel or lubricant, and after any amount of other chemical

products has escaped. All stained soil resulting from the Contractor's use of chemicals and fuel is to be cleaned up and disposed of at an approved disposal site.

- .5 Storage of large amounts of fuel (more than 900 L) in the Park is not permitted. Refuelling of on-line equipment from storage facilities located outside Park boundaries is strongly preferred. Storage of any fuel has to occur only in previously approved locations, and with Park consent. The Contractor is expected to be prepared to effect the containment and cleanup of all spills related to the Work.
- .6 Storage of hazardous material, including explosives, shall not be permitted within the Park, except for quantities which shall normally be expected to be utilized in a day of Work, and which are not permitted to stockpile.
- .7 Emulsion storage tanker and transfer of emulsion from tanker to spray vehicle are not permitted within National Park.
- .8 Equipment maintenance is not permitted within the Park boundaries.

1.16 TREATED WOOD

- .1 Creosote is not approved for use in Parks.
- .2 Workers should be made aware of the possible health risks associated with exposure to CCA or creosote treated timber as well as the recommended safe practices for handling such materials.
- .3 Disposal of treated wood wastes including saw-dust must be outside of the Park, and in accordance with all applicable Provincial and Municipal regulations. Similar attention must be given to disposal of the replaced guiderail posts which have been treated with creosote.

1.17 SITE DECOMMISSIONING

- .1 All work sites must be returned to a neat and tidy condition upon site abandonment.

1.18 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.
- .3 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site or in structures demolished, shall remain property of Canada. Protect such articles and request direction from Departmental Representative.
- .4 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during construction and await written instructions before proceeding with work in the area.

1.19 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 77 00 – Closeout Procedures
- .3 Section 01 78 00 – Closeout Submittals

1.2 DEFINITIONS

- .1 Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed.
- .2 Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

1.3 INSPECTION

- .1 Allow Departmental Representative adequate time and access to Work. If part of Work is in preparation at locations other than Place of Work, allow time and access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.
- .4 Departmental 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, Contractor to correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- .5 The Departmental Representative shall participate in the taking of survey of all quantities with the Contractor responsible to complete the surveys in the presence of the Departmental Representative.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged and coordinated by Departmental Representative for purpose of inspecting and/or testing portions of Work. These agencies include, but are not limited to, concrete testing, structural steel testing,

coating testing and inspection, aggregate tests, compaction tests, asphalt tests. Cost of such services will be borne by Departmental Representative. The Contractor remains responsible for:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Mill tests and certificates of compliance.
 - .4 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.
- .2 Provide equipment and materials required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relax responsibility of Contractor 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 additional cost to Contract. Contractor shall pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies access and required time to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.
- .3 Make good work disturbed by inspections and tests.

1.6 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such agency directly.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Deliver in required quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

1.7 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good damages to existing or new work, including work of other Contracts, resulting from removal or replacement of defective work.

- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.8 TESTING BY CONTRACTOR

- .1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents. Contractor is responsible for PDA testing.

1.9 REPORTS

- .1 Submit the original and electronic copy of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.10 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested and as specified in relevant Technical Specification section.
- .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.

1.11 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections or as requested by Departmental Representative.

1.12 PILE / PDA-TESTING

- .1 Pile / PDA Testing is the responsibility of the Contractor.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29.06 – Health and Safety
- .3 Section 01 35 43 – Environmental Procedures
- .4 Section 01 55 26 – Traffic Regulation
- .5 Section 01 56 00 – Temporary Barriers and Enclosures

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.
 - .4 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for all temporary structures which are required to be engineered. Shop drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

1.4 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.5 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.

- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs as required.

1.6 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists cranes to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted in the area of the site provided it does not disrupt performance of Work, interfere with normal traffic flow and only after obtaining agreement with the Departmental Representative. Parking will not be permitted within 3 m from the edge of pavement.
- .2 Provide and maintain adequate access to project site.
- .3 Keep parking areas clean and maintained during period of Contract.

1.9 SECURITY

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
- .4 Departmental Representative's Site office.
 - .1 Provide separate temporary office trailer for Departmental Representative.
 - .2 Trailer to be minimum 6.1 m in length, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.
 - .3 Trailer to be insulated and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
 - .5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.

- .6 Provide telephone and fax machine and communications hook-up for telephone, fax and internet. Capacity of internet to be suitable for business applications. Hardware and all communication connections to be maintained throughout the project.
- .7 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory, mirror and hand wash facility (chemical or potable water and soap) and maintain supply of paper towels and toilet tissue.
- .8 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
- .9 Equip office with water cooler / filter and maintain supply of bottled water.
- .10 Maintain in clean condition.
- .11 If site office cannot provide telephone and internet connection, a second office within 3 km of the site is to be provided which conforms to all conditions including telephone and internet connection.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.12 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Refer to Section 01 55 26 – Traffic Regulation.
- .2 Provide access and temporary relocated roads as necessary to maintain traffic.
- .3 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .4 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .5 Protect travelling public from damage to person and property.
- .6 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .7 Verify adequacy of existing roads and allowable load limit on these roads. Contractor responsible for repair of damage to roads caused by construction operations.
- .8 Construct access and haul roads necessary.

- .9 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .10 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .11 Dust control: adequate to ensure safe operation at all times.
- .12 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .13 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .14 Provide snow removal during period of Work.
- .15 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.14 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

Not Used.

Part 3 Execution

3.1 GENERAL

- .1 Construct and maintain construction facilities in accordance with applicable Sections contained in these specifications.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

END OF SECTION

Part 1 General.

1.1 REFERENCES

- .1 Government of Canada Weights and Measures Act 1985.
- .2 Government of Canada Weights and Measures Regulations 1990.

1.2 CERTIFICATION

- .1 Prior to use, Contractor shall have weigh scales certified as meeting requirements of Statutes of Canada, Weights and Measures Act. Display certificate in a visible location.

1.3 OPERATION

- .1 Contractor shall provide a weigher at scale location to issue tickets and prepare a daily summary sheet to submit to Departmental Representative. Tickets shall include information to identify the truck and registered weight along with tare, gross and net weights, and time of dispatch.
 - .1 Tickets shall not be issued to vehicles which exceed the vehicle's registered weight.

Part 2 Products

2.1 EQUIPMENT

- .1 Weigh scales: of sufficient capacity to weigh loaded vehicles in a single operation. The weigh scale shall be calibrated in SI units.
- .2 Scale house:
 - .1 To enclose mass indicator and where weigher can perform work and maintain records.
 - .2 Waterproof, one sliding window facing scale platform, one other window for cross ventilation, entrance door not to face on to scale platform.
- .3 Approved weigh tickets, in triplicate, with consecutive serial numbers shall be provided by Contractor.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide, install and maintain scales and scale house at location approved by Departmental Representative.
- .2 Remove scales and scale house when no longer required and as directed by Departmental Representative. Level approach ramps.
- .3 The work shall include installation of the anchorage assemblies.

3.2 MAINTENANCE

- .1 Maintain scale platform and scale mechanism clean and free from gravel, asphalt, snow, ice and debris.
- .2 Maintain approach ramps in good condition free from sags and ruts.
- .3 Have scales re-tested and re-certified if requested by Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section is to provide traffic control as stipulated in the Newfoundland and Labrador Department of Transportation and Works (NLDTW) Traffic Control Manual (TCM).
- .2 Given the nature of the highway, its critical transportation link, effect on motorists, etc. it is imperative that Park personnel be kept notified as to the number of construction areas, their locations, duration of work, etc. This information must be provided by the contractor to the Park Communications staff on an ongoing basis.
- .3 A Traffic Control Plan must be approved by the Departmental Representative prior to commencing any work. Traffic Control Plan to be submitted prior to the pre-construction meeting.
- .4 The Departmental Representative reserves the right to direct the contractor to reduce either the number or length of traffic control work areas during peak traffic volumes or when cumulative delays exceed the specified maximum.
- .5 Two lanes of unrestricted access must be maintained throughout construction except for limited single lane closures, which must be approved by the Departmental Representative.

1.2 REFERENCE STANDARD

- .1 Regulate traffic in accordance with the Public Highways Act (Newfoundland and Labrador) as stipulated in the TCM distributed by the Newfoundland and Labrador Department of Transportation and Works (NLDTW).
- .2 The Departmental Representative reserves the right to direct the contractor to reduce either the number or length of traffic control work areas during peak traffic volumes or when cumulative delays exceed the specified maximum.

1.3 DEFINITIONS

- .1 Traffic delay: period of time for which vehicle(s) is stopped or delayed in travelling through the contract limits due to the performance of Work on this project. Traffic delay applies to both single lane operation and road closure.
- .2 Road closure: period of time for which the road within the contract limits is not open to the public.

1.4 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work
- .2 Section 01 35 29.06 – Health and Safety
- .3 Section 01 56 00 – Temporary Barriers and Enclosures

1.5 REFERENCES

- .1 Manual of Uniform Traffic Control Devices (MUTCD) for Streets and Highways.

- .2 Newfoundland and Labrador Department of Transportation and Works (NLDTW) Traffic Control Manual (TCM) – Latest Edition.

1.6 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 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 will permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Do not close any lanes of road without written approval of Departmental Representative. Before re-routing traffic, erect suitable signs and devices in accordance with instructions contained in TCM. Provide sufficient crushed gravel (50 mm thickness of Aggregate Base Course) to ensure a smooth riding surface during work.
- .4 Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.
 - .1 Provide detours as indicated and phasing of traffic throughout construction shall be carried out as indicated on the drawings, unless otherwise approved by the Departmental Representative.
 - .2 Traffic is not permitted to travel on subgrade or granular sub-base. A minimum 50 mm thickness of aggregate base course must be constructed prior to opening to traffic.
- .5 Ensure at least 2 lanes of traffic at all times except for limited single lane closures as approved by the Departmental Representative.
- .6 As indicated, provide well graded, gravelled detours or temporary roads to facilitate passage of traffic around restricted construction area. Provide and maintain signs and roadway.
 - .1 Do grading for detour in accordance with Section 31 24 13 – Roadway Embankments.
 - .2 Place and compact granular sub-base in accordance with Section 32 11 16.01 – Granular Sub-Base.
 - .3 Place and compact granular base in accordance with Section 32 11 23 – Aggregate Base Courses.
- .7 Provide and maintain reasonable road access and egress to property fronting along work under Contract and in other areas as indicated, unless other means of road access exists that meet approval of Departmental Representative.
- .8 All flag persons and traffic control personnel shall have successfully completed a traffic control training course. Proof of training for all persons shall be available on site at all times.

- .9 A mechanical sweeper is to be used to remove debris tracked onto the paved surfaces. Paved surfaces shall be sweep regularly, and at least daily, to remove debris.

1.7 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain NLDTW approved temporary: heavy barricades, 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 All traffic signs are to be bilingual or symbolic.
- .3 Supply and erect signs, delineators, barrels, barricades and miscellaneous warning devices as specified in TCM and project drawings.
- .4 Place signs and other devices in locations recommended by TCM.
- .5 All flag persons and traffic control personnel shall have successfully completed a traffic control training course approved by the WorkNL. Proof of training for all persons shall be available on site at all times. The contractor shall provide an Accredited Sign Supervisor to be on site at all times when active construction is taking place. The Accredited Sign Supervisor will be responsible to supervise the placement and dismantling of all temporary condition signs and devices that indicate to the road user that highway construction activity exists and also to ensure that proper traffic control procedures are carried out in accordance with the TCM. The Accredited Sign Supervisor is considered part of the contractor's supervision and administration staff and compensation and the provision of this individual is considered incidental to the work.
- .6 A traffic control plan and emergency response plan must be approved by the Departmental Representative prior to commencing any work.
- .7 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.

1.8 PORTABLE VARIABLE MESSAGE SIGNS

- .1 General
 - .1 It is a requirement that electronic signage (trailer mounted), Portable Variable Message Signs (2 PVMS), be employed at both ends of the work area (2 locations), notifying the general public that construction will be occurring along with anticipated delay times, etc. Notification signage is critical for this project, given the traffic volumes and potential for accidents to occur.
 - .2 PVMS shall be located at a safe distance away from traffic. Where temporary pads are required they shall be constructed to ensure water flow is not blocked.
- .2 Operating Characteristics
 - .1 The PVMS shall exhibit the following operating characteristics while in use:
 - .1 Light emitting diode (LED) technology or hybrid LED/Flip Disk Technology.

- .2 Antiglare polycarbonate sheeting.
 - .3 Solar powered.
 - .4 Capable of operating for 7 consecutive days on battery power supply with solar panels disconnected.
 - .5 Shall include all hardware and software necessary to facilitate reliable local and remote sign control.
 - .6 Programmable (25 message sequence for one week duration).
 - .7 Capable of displaying a multiphase message with variable dwell times for each phase.
 - .8 Text of message shall not scroll or travel horizontally or vertically across the face of the sign.
 - .9 Capable of displaying 3 lines of 8 characters, each character being approximately 457 mm high.
 - .10 Each character matrix comprised of 35 pixels, 5 wide by 7 high.
 - .11 Message visible from 500 metres away in all ambient light conditions.
 - .12 Message legible from 50 m to 300 m away in all ambient light conditions.
 - .13 Ability to raise the bottom of the display board a minimum of 1.5 metres above ground level.
 - .14 Flat black background on the display area when the pixels are in the off position.
 - .15 Trailer painted orange or yellow.
 - .16 Capability to accurately level the sign and aim it towards oncoming traffic.
 - .17 Photo sensor array to enable the luminance of the sign to be controlled both automatically and manually in relation to ambient light levels.
 - .18 Locking device to prevent rotation of the sign in winds up to 10-km/hour, while the sign is in display mode.
- .3 Trailer Mounting
- .1 The maximum dimensions of the Portable Variable Message Sign and trailer assembly while in display mode shall be as follows:
 - .1 Maximum overall height = 4.5 metres.
 - .2 Maximum overall width = 3.75 metres.
 - .3 Maximum overall length = 5.5 metres.
 - .4 Maximum gross unit weight = 2500 kilograms.
- .4 Conspicuity Markings
- .1 PVMS trailer assemblies shall require high reflectivity micro-prismatic fluorescent sheeting tape (or equivalent) (e.g. diamond grade or Type VII) (meeting ASTM standard E991 and ASTM E1247 for fluorescent materials). The reflectorized tape shall be of alternating, uniform white and orange or white and yellow sections. Sections of reflectorized tape shall be placed around the trailer frame, tongue or other outermost dimension, at uniform height and width such to reflect the light from the headlights of a vehicle approaching from any direction.

- .2 PVMS sign assemblies shall require high reflectivity micro-prismatic fluorescent sheeting type (or equivalent) (e.g. diamond grade or Type VII) (meeting ASTM standard E991 and ASTM E1247 for fluorescent materials). The reflectorized tape shall be construction orange in colour, and 13 mm in width. The tape shall surround the outside of the sign assembly on all sides and be uniform distance from the outmost pixels.

1.9 CONTROL OF PUBLIC TRAFFIC

- .1 Provide traffic control personnel who have a valid provincial license and are trained in accordance with, and properly equipped as specified in TCM manuals in following situations:
 - .1 When public 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 where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .3 When workers or equipment are employed on travelled way over brow of hills, around sharp curves or at 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 vehicles are required.
- .2 All Traffic Control Personnel shall be equipped with portable radios only, not cellular devices, of sufficient range to ensure continuous communication within the traffic control zone. Flag persons using a cellular device shall be removed from the site immediately. PCA will not be held responsible for loss of time or delay incurred due to removal of such an individual.
- .3 All construction vehicles shall operate in accordance with and subject to traffic control restrictions and operations in place on the project.
- .4 In addition to traffic control during the normal hours of work, the contractor shall have a responsible person on site at all times to monitor that the traffic signage is working properly (including nights, weekends and holidays).

1.10 TRAFFIC MANAGEMENT PLAN REQUIREMENT

- .1 Contractor to provide a Traffic Control plan, prior to construction, for approval by the Departmental Representative. The Traffic Control plan shall be site specific and cover all temporary traffic conditions during construction on the project. The Traffic Control plan shall include:
 - .1 Personnel responsible (both contractor and sub-contractor), credentials and contact information;

- .2 Traffic Monitoring and Contacts, during work hours and after hours emergency contact;
- .3 Response to incidents;
- .4 Temporary conditions during construction, including equipment delivery and set-up, entering and exiting site, girder delivery and erection procedures;
- .5 Signage and additional traffic control measures.

1.11 OPERATIONAL REQUIREMENTS

- .1 Conduct operations as to create the minimum of inconvenience to traffic.
- .2 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 herein and approved in writing by Departmental Representative to protect and control public traffic, existing conditions for traffic may be restricted as follows:
 - .1 In accordance with TCM.
 - .2 The maximum cumulative traffic delay through the limits of construction shall not exceed 10 minutes.
 - .3 Closure plans shall be set in place by the Contractor to ensure the safe passage of emergency vehicles throughout the construction area within 15 minutes of being alerted by emergency response personnel. The 15 minute emergency response time shall be able to be met during all phases of construction and a dedicated on-site emergency phone line shall be set up by the Contractor to achieve this.
- .3 Temporary concrete (F-shape) barriers shall be installed in locations indicated on the drawings, where existing guide rail has been removed or where conditions warrant guide rail to protect the travelling public.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 29.06 – Health and Safety
- .2 Section 01 55 26 – Traffic Regulation
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 02 41 16 – Structure Demolition

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Newfoundland and Labrador Department of Transportation and Works (NLDTW)
 - .1 Traffic Control Manual (TCM)

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.4 HOARDING

- .1 Erect temporary site enclosures when and where required using 38 x 89mm construction grade lumber framing at 600mm centres and 1200 x 2400 x 13mm exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically as indicated flush and butt jointed.
- .3 Provide one or two lockable truck entrance gates and at least one pedestrian door if directed by Departmental Representative and conforming to applicable traffic restrictions on adjacent roads. Equip gates with locks and keys.
- .4 Erect and maintain pedestrian walkways if directed by Departmental Representative including roof and side covers, complete with signs and electrical lighting as required by law.
- .5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .6 Erect temporary site enclosure where and when required using new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one lockable truck gate. Maintain fence in good repair.

- .7 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.5 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, and open edges of structures or as indicated in Contract Documents. Provide as required by governing authorities and as indicated.

1.6 WEATHER ENCLOSURES

- .1 Provide weather tight closures where and when required to facilitate construction operations.
- .2 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

- .1 Provide dust tight screens to localize and control dust generating activities, and for protection of workers and the environment.
- .2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.9 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.10 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 REFERENCES

- .1 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .4 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date of issue is specifically noted.

1.3 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in a cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations.

1.1 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- 1.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.3 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify

Departmental Representative if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 REMEDIAL WORK

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

1.9 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.10 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of new and existing bridges. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.11 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.

1.2 REFERENCES

- .1 Owner's identification of existing survey control points and property limits.

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in Newfoundland and Labrador, acceptable to Departmental Representative.

1.4 SURVEY REFERENCE POINTS

- .1 Existing horizontal and vertical working points are designated on drawings.
- .2 Locate, confirm and protect working points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Departmental Representative.
- .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

- .1 Establish permanent bench marks on site, as required, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Establish foundation elevations.
- .7 Establish lines and levels for mechanical and electrical work.
- .8 Special care shall be taken when setting girder bearing elevations and deck screed elevations.

1.6 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform with Contract Documents.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice from access to site, bank/pile snow in designated areas only.
- .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.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 A mechanical sweeper is to be used to remove debris tracked onto the paved surfaces. Paved surfaces shall be swept regularly, and at least daily, to remove debris.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .3 Remove waste products and debris including that caused by Owner or other Contractors, and leave Work clean and suitable for occupancy.
- .4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Inspect finishes and ensure specified workmanship and operation.

- .7 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .8 Remove dirt and other disfiguration from exterior surfaces.
- .9 Sweep and wash clean finished paved areas within the work site.
- .10 Clean downspouts and drainage systems.
- .11 Remove debris and surplus materials from site.
- .12 Remove snow and ice from access to site.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work, conduct meeting with Departmental Representative to review and discuss PCA's Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environmental damage.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 02 41 16 – Structure Demolition

1.3 REFERENCES

- .1 Newfoundland and Labrador's Solid Waste Resource Strategy.
- .2 Newfoundland and Labrador Environmental Act, Regulation 82 (Latest Issue), Used Oil Regulations.

1.4 DEFINITIONS

- .1 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .2 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .3 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .5 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .6 Salvage: removal of structural and non-structural structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .7 Separate Condition: refers to waste sorted into individual types.
- .8 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

- .9 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled.
- .10 Waste Reduction Work Plan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials.

1.5 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Material Source Separation Plan
 - .2 Waste Reduction Workplan and any revisions to the document.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Waste Reduction Work Plan (WRW).
 - .2 Submit 2 copies of Waste Source Separation Program (WSSP).

1.7 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations.
- .3 Structure WRW to prioritize actions and follow as first priority Reuse, then followed by Recycle.
- .4 Describe management of waste.
- .5 Post WRW or summary where workers at site are able to review content.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up. The Demolition Waste Audit (DWA), with related weigh bills and /or receipt must be submitted on a monthly basis with the Contractor's monthly Progress claim.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Locate containers in locations to facilitate deposit of materials without hindering daily operations.
- .5 Locate separated materials in areas that will minimize material damage.

- .6 Collect, handle, store on-site, and transport off-site salvaged materials in separated condition.
- .7 Transport to approved and authorized recycling facility.

1.9 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as specified in MSSP.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .6 Separate and store materials produced during project in designated areas.
- .7 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is required.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner and the like into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.11 USE OF SITE FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by PCA.

1.12 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

Not Used.

Part 3 Execution

3.1 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean up Work area as work progresses.
- .2 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .3 Source separate materials to be reused/ recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 78 00 - Closeout Submittals.

1.2 INSPECTION AND DECLARATION

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies.
 - .2 Contractor to correct Work accordingly.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative and Contractor.
 - .2 When Work is deemed incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
 - .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .6 Final Payment:
 - .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
 - .2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
 - .7 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment. Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with applicable sections of these specifications.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 71 00 – Examination and Preparation
- .4 Section 01 77 00 – Closeout Procedures

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide As-built documents and samples.
- .3 Provide final site survey certificate.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide a full sized paper copy of plans marked up with red ink to show changes made during construction. Title block must indicate as-built drawings and bear contractors name, stamp and signature.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.

- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
- .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 INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of opaque drawings.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface features.
 - .2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

- .3 Field changes of dimension and detail.
- .4 Changes made by change orders.
- .5 Details not on original Contract Drawings.
- .6 References to related shop drawings and modifications.
- .4 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 FINAL SURVEY

- .1 Submit final site as-built survey plan in both electronic and paper format. Electronic format to be CAD and PDF copy of paper format. Paper format to be stamped and signed by qualified registered land surveyor, licensed to practice in Newfoundland and Labrador. Survey information to include all features within the extents of the site and extend to existing ground prior to construction. Streambed within the site is also to be surveyed. Maximum spacing between survey points not to exceed 10 meters.

1.8 WARRANTIES AND BONDS

- .1 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .2 Except for items put into use with Department Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29.06 – Health and Safety
- .3 Section 01 35 43 – Environmental Procedures
- .4 Section 01 45 00 – Quality Control
- .5 Section 01 56 00 – Temporary Barriers and Enclosures
- .6 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .7 Section 31 23 33.02 – Foundation Excavation Bridge

1.2 REFERENCES

- .1 Definitions:
 - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
 - .2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
 - .3 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials.
- .2 Reference Standards:
 - .1 Canadian Environmental Protection Act (CEPA)
 - .2 CSA International
 - .1 CSA S6-14, Canadian Highway Bridge Design Code.
 - .2 CSA S350-M1980 (2003), Code of Practice for Safety in Demolition of Structures
 - .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:

- .1 Convene pre-demolition meeting 1 week prior to beginning work of this Section with Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Verify existing site conditions adjacent to demolition work.
 - .3 Co-ordination with other construction sub-trades.
- .2 Ensure key personnel, including site supervisor, project manager and subcontractor representatives at minimum attend.
- .3 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Submit 2 copies of certified receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.
- .4 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .5 An engineered demolition plan is required. The demolition plan shall be designed by an engineer Licensed to Practice in the Province of Newfoundland and Labrador, Canada. Submit drawings stamped and signed by qualified professional engineer registered in or licensed in Province of Newfoundland and Labrador, Canada. Environmental controls shall be shown on the plan which will be subject to review and approval by DFO. The demolition plan shall be submitted to the Departmental Representative four (4) weeks prior to initiating removal of the existing structure. The demolition plan shall include; positioning of equipment during all phases of demolition, imposed surcharge loading and stability of the existing structure throughout the various phases of demolition, embankment stability and imposed loading on adjacent structures and complete set of phased demolition drawings.

1.5 QUALITY ASSURANCE

- .1 Refer to Section 01 45 00 – Quality Control.
- .2 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA, applicable Provincial/Territorial and Municipal regulations.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Divert excess materials from landfill to site approved by Departmental Representative.
 - .1 Crush demolished concrete from the existing structure to a size suitable for transportation to off-site disposal.

1.7 ENVIRONMENTAL PROTECTION

- .1 Ensure work is done in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 No part of the structure shall enter the watercourse during demolition.
- .4 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .5 Cover or wet down dry materials and waste to prevent blowing dust and debris.
- .6 Contractor shall be aware that no machinery will be allowed in the water.
- .7 The Contractor shall respect the allowable in water work times outlined in Section 01 11 00 – Summary of Work.
- .8 Materials from existing structure shall not be used as backfill unless otherwise approved by the Departmental Representative in writing.

1.8 EXISTING CONDITIONS

- .1 Refer to Drawings indicating existing and temporary conditions.

1.9 SCHEDULING AND STAGING

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 In event of unforeseen delay notify Departmental Representative in writing.
 - .2 The Contractor is to respect all restrictions on in water work as outlined in the Contract Documents.
- .2 Stage bridge demolition as follows:
 - .1 Demolition of the existing bridge shall not commence until traffic is permanently diverted onto the realigned highway and the new bridge structure.
 - .2 Traffic shall not be interrupted on the new structure and realigned highway during demolition activities.

Part 2 Products

2.1 EQUIPMENT

- .1 Equipment and heavy machinery to:

- .1 On-road vehicles to meet applicable emission requirements as prescribed in CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations, CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
- .2 Off-road vehicles to meet applicable emission requirements as prescribed in EPA CFR 86.098-10 and EPA CFR 86.098-11.
- .2 Contractor to implement an anti-idling policy. Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PROTECTION

- .1 Prevent movement, settlement or damage of adjacent structures.
 - .1 Provide bracing, shoring and underpinning as required.
 - .2 Repair damage caused by demolition as directed by Departmental Representative.
- .2 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
- .3 Prevent debris from blocking surface draining system.

3.2 PREPARATION

- .1 Do Work in accordance with Section 01 35 29.06 – Health and Safety.
- .2 Contact utilities prior to commencing work. Coordinate removals and relocations with respective utilities.
- .3 Disconnect any utility affected by the required work.
 - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .4 Disconnect and cap any utility to remain.
- .5 Do not disrupt active or energized utilities designated to remain undisturbed.
- .6 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .7 Protection of in-place conditions:
 - .1 Work in accordance with Section 01 35 43 - Environmental Procedures.

- .2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades, properties.

3.3 SAFETY CODE

- .1 Blasting operations not permitted during demolition.

3.4 REMOVAL OF HAZARDOUS WASTE

- .1 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger to site or during disposal.

3.5 DEMOLITION

- .1 Demolish structure as indicated in Clause 1.9.2.
- .2 Demolition of the existing structure includes the entire superstructure (deck, curbs, railings, asphalt, and girders) and the demolition of the existing substructure and foundations (including piles) to 1 meter below existing streambed. At end of each day's work, leave Work in safe and stable condition.
- .3 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- .4 Remove structural components and asphaltic material.
- .5 Only dispose of material specified by selected alternative disposal option as directed by Departmental Representative.
- .6 Dispose of materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .7 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

3.6 STOCKPILING

- .1 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, highway users, access to the river, or hauling procedures.

3.7 REMOVAL AND DISPOSAL

- .1 Remove stockpiled material designated for alternate disposal, as directed by Departmental Representative, when it interferes with operations of project construction, highway users or access to the river.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Transport material designated for alternate disposal using approved haulers and receiving organizations listed in the Waste Reduction Workplan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.

- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 20 00 – Concrete Reinforcing
- .4 Section 03 30 00 – Cast-in-Place Concrete
- .5 Section 03 30 51 – Concrete for Bridge Decks
- .6 Section 07 92 00 – Concrete Joint Sealant

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A23.4, Precast Concrete – Materials and Construction
 - .3 CSA-O86-14, Engineering Design in Wood.
 - .4 CSA O121-08(R2013), Douglas Fir Plywood.
 - .5 CSA O151-09 (R2014), Canadian Softwood Plywood.
 - .6 CSA O153-13, Poplar Plywood.
 - .7 CAN/CSA-O325-07(R2012), Construction Sheathing.
 - .8 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .9 CAN/CSA-S269.1-1975 (R2003), Falsework for Construction Purposes
 - .10 CAN/CSA-S269.3-M92(R2013), Concrete Formwork, National Standard of Canada

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings and calculations stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada at least four (4) weeks before construction. The submission is intended for information purposes only and shall in no way relieve the Contractor of full responsibility to carry out work related in accordance with CSA S269.3 for Concrete Formwork and CSA S269.1 for Falsework.
 - .2 In addition to the design of the formwork, the formwork designer shall also provide calculations that consider the local load transfer of formwork loads to the girder section such that the local load effects do not locally overstress the girder flanges or webs and that the loads can be safely transferred into the girder section / global system.

- .3 Casting of the deck shall be accomplished in a balanced fashion as indicated on the Contract Drawings.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork/falsework as directed by formwork Engineer.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with jurisdictional requirements.
- .2 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.
- .3 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign material. Handle and erect the fabricated formwork so as to prevent damage.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic waste in designated containers.
 - .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC's).

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA O121, CAN/CSA-O86.
 - .2 For concrete with special architectural features such as the end crash block pedestals and exposed sides of bridge deck and curbs, use formwork materials to CSA-A23.1/A23.2.
 - .3 Rigid insulation board shall be provided between approach slab and wingwalls.
 - .4 Formwork shall be constructed from lumber devoid of warped defects in order to achieve a face alignment free of distortion. This shall apply to all panel forms including prefabricated boards, plywood and steel panels.
 - .5 Formwork on exposed concrete surfaces shall be new or like new to achieve a quality aesthetically pleasing finish.

- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Holes to be filled with non-shrink grout.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs (applied before concrete sealers and coatings are applied). The exposed surfaces of the concrete on the deck, curbs, abutments, and wingwalls are to be considered 'Architectural Concrete' for this project.
 - .3 Form tie components which remain embedded in concrete are to be galvanized or non-metallic. Dissimilar metals which are in contact must be separated by denso tape barrier.
- .3 Form release agent: non-toxic, biodegradable, low VOC. Form release agents must be compatible with waterproofing systems where applicable.
- .4 Falsework materials: to CSA-S269.1.
- .5 Sealant: to Section 07 92 00 – Concrete Joint Sealant.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 Refer to structural drawings and Item 2.1.2 for concrete members requiring architectural exposed finishes.
- .4 Do not place shores and mud sills on frozen ground.
- .5 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .6 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .7 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .10 Construct forms for architectural concrete as indicated.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .11 Built in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

- .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including concrete texturing.
- .2 Anchors and inserts cast into the concrete shall be non-metallic or galvanized metal and either be isolated from dissimilar metals by either a 30 mm clear spacing or denso tape barrier on the formwork anchors / inserts.
- .12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Notify Departmental Representative prior to form removal.
- .2 Form removal times are dependent on proper curing in accordance with CAN/CSA-A23.1 and CAN/CSA-S269.3. Provide written evidence of concrete strength to the Departmental Representative 24 hours prior to form removal to show the suitable strength has been achieved. Contractor shall pay for the concrete cylinder strength tests to demonstrate concrete strength prior to form removal.
- .3 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Two (2) days for walls.
 - .2 Four (4) days for beam soffits, slabs, decks and other structural members, or two (2) days when replaced immediately with adequate shoring to standard specified for falsework.
 - .3 Two (2) days for footings and abutments.
- .4 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring. No vehicle loading or backfilling of abutments shall take place until concrete reaches design strength, unless otherwise approved in writing by Departmental Representative.
- .5 If formwork is used to aid curing, it shall not be removed until seven days after the concrete placement.
- .6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 03 10 00 – Concrete Forming and Accessories
- .4 Section 03 30 00 – Cast-in-Place Concrete
- .5 Section 03 30 51 – Concrete for Bridge Decks

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A143/A143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A780 / A780M 09 (2015), Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA-A23.3-14, Design of Concrete Structures.
 - .3 CSA-A23.4, Precast Concrete – Materials and Construction.
 - .4 CAN/CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .5 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .6 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .7 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .8 CSA S6-14, Canadian Highway Bridge Design Code.
 - .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315, except as noted herein. Shop drawings are to be submitted at least four (4) weeks prior to commencing fabrication for review and approval. The Contractor retains responsibility for correctly detailing reinforcement, but the shop drawings must be approved for conformity with the design. Fabrication shall not proceed until the final approval of shop drawings. Shop drawings shall be stamped by a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.
- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details (Reference Table 3.3.1, Minimum Bend Diameter for Reinforcing Steel (400W)).
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices as specified / if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide Class B tension lap splices unless otherwise indicated.

1.4 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2.3 - SOURCE QUALITY CONTROL.
 - .1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
 - .2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400W (weldable), deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 All reinforcing steel shall be hot dipped galvanized in accordance with CAN/CSA-G-164-M. All minor damage to the galvanizing shall be touched up with organic zinc paint.
- .4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M. All tie-wires, chairs and bar supports and other material used for the installation of galvanized reinforcing bars shall be covered, either with powdered epoxy resin, or acceptable material, at all contact points and within 50 mm of exposed faces, or be comprised of an acceptable non-metallic material to avoid galvanic reaction with galvanized repair / damage to galvanized coating.
- .5 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 - ACTION AND INFORMATIONAL SUBMITTALS.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices:
 - .1 The use of mechanical rebar splices shall be subject to approval of Departmental Representative.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, except as noted herein (see Table 3.3.1).
- .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, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

- .1 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.
- .2 All steel reinforcing bars shall have the necessary net sectional area, and shall be cut to the exact lengths, and bent cold to the exact forms and dimensions, shown on the approved plans, or otherwise required, before galvanizing or being placed in position. Bending shall be accurately done, in a bending machine and no welding or heating of any bars shall be allowed, except with written approval from the Departmental Representative. All stirrups and hoops shall accurately fit the rods, and all bends shall be taken out of bars to be used as straight members.

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.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete placement.
- .4 All reinforcing bars shall be placed and held rigidly in the exact positions in the forms as shown on the approved plans, or otherwise required, and there shall be no displacement of the same by the placing and tamping of the concrete. Adjusting or moving the bars, while the concrete is being placed, shall not be permitted, unless specified on the plans. Concrete protection required for reinforcing steel shall be in accordance with the Contract Documents, or as directed by the Departmental Representative. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the

reinforcement, after being cleaned and placed in position, has been examined and approved by the Departmental Representative. The minimum bend diameter shall conform to the Table 3.3.1, below. Bending of galvanized reinforcing steel will not be permitted after coating.

- .5 To avoid contact between dissimilar metals, galvanized reinforcing shall either be separated from black steel (uncoated steel) with a clear space of at least 30 mm, otherwise the galvanized reinforcing shall be locally wrapped with denso tape to provide the required separation.

Table 3.3.1

Minimum Bend Diameter for Reinforcing Steel (400W)

<u>Bar Size (mm)</u>	<u>Bend Diameter (mm)</u>
10	70
15	90
20	150
25	200
30	250
35	300
45	450
55	600

3.4 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of galvanized reinforcing steel with zinc rich paint that is a compatible finish to provide continuous coating. Cold galvanizing touch-up procedure and product shall meet with the approval of the Departmental representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29.06 – Health and Safety
- .3 Section 01 45 00 – Quality Control
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .5 Section 03 10 00 – Concrete Forming and Accessories
- .6 Section 03 20 00 – Concrete Reinforcing
- .7 Section 03 30 51 – Concrete for Bridge Decks
- .8 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

- .1 ANSI/ACI 117-06, Specifications for Tolerances for Concrete Construction and Materials and Commentary.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C457-08, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
 - .4 ASTM C494/C 494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017/C 1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM C1202-07, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A23.5, Supplementary Cementing Materials
 - .3 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
 - .4 CSA S269.3-M92(R2008), Concrete Formwork.
 - .5 CAN/CSA-A3000-13, Cementitious Materials Compendium.
 - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.
 - .6 CSA S6-14, Canadian Highway Bridge Design Code

1.3 DESIGN REQUIREMENTS

- .1 Alternative 1 – Performance: in accordance with CSA-A23.1/A23.2, and as described in MIXES of PART 2 – PRODUCTS.
 - .1 Concrete mixture designs shall be proportioned as normal density concrete in accordance with CSA-A23.1 latest edition, Alternative #1. Concrete shall be proportioned using Portland cement, Type SF silica fume, fly ash, fine and coarse aggregates, air entraining, water reducing, and superplasticizing and / or set retarding admixtures. Other supplementary cementing materials may include Class F fly ash. Set retarding admixtures may be used as ambient and site conditions warrant.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 At least fifteen days prior to the start of the concrete construction schedule, a pre-concrete conference must be held. The mix designs shall be reviewed and the required methods and procedures to achieve the required concrete shall be discussed. Develop and send a conference agenda to all attendees ten days prior to the scheduled date of the conference.
- .2 Arrange for representatives of all parties concerned with the concrete work to attend the conference, including but not limited to the following:
 - .1 The contractor's superintendent
 - .2 A representative from the laboratory responsible for the concrete mix design
 - .3 A representative from the laboratory responsible for the field quality control
 - .4 The concrete subcontractor
 - .5 The ready-mix concrete producer
 - .6 The admixture manufacturer supplier
 - .7 The hardener supplier
 - .8 The concrete pumping contractor
 - .9 The Engineer
 - .10 The Departmental Representative
- .3 Record minutes of the meeting and distribute to all parties concerned within five days of the meeting. Submit minutes to Departmental Representative.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit the following at least four (4) weeks prior to the commencing concrete work:
 - .1 Certification from the qualified independent inspection and testing company that plant, equipment and materials to be used in the concrete comply with requirements of CSA-A23.1/A23.2.
 - .2 Manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
 - .1 Portland cement
 - .2 Blended hydraulic cement

- .3 Supplementary cementing materials
- .4 Admixtures
- .5 Water
- .6 Aggregates
- .3 Mix designs for concrete, mix proportions and aggregate sources, which will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.
- .4 Certification for the concrete supplier from the Atlantic Provinces Ready Mixed Concrete Association – APRMCA Concrete Production Facilities Certification Program.
- .3 Include in the submission of the mix designs, test results for each mix containing the following information:
 - .1 Plastic Concrete Tests
 - .2 Slump (CSA A23.2-5C)
 - .3 Air Content of Plastic Concrete by Pressure Method (CSA A23.2-4C)
 - .4 Mass Density and Yield (CSA A23.2-6C)
 - .5 Compressive Strength Testing (CSA A23.2-9C)
 - .6 2 cylinders to be tested at 28 days
 - .7 Air Void Analysis on Hardened Concrete (ASTM C457) tested at 7 days
 - .8 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (ASTM C1202) tested at 56 days
 - .9 Alkali Reactivity Test Results
- .4 Submit four (4) weeks in advance of concrete placement, relevant test data for all aggregate materials indicating conformance to the requirements of CSA-A23.1 and this specification. The test results required, but not be limited to, shall include:
 - .1 Sieve Analysis of Fine and Coarse aggregate
 - .2 Amount of Material Finer than 80 µm in Aggregate
 - .3 Bulk Relative Density and Absorption of Fine and Coarse Aggregate (SSD basis)
 - .4 Fineness Modulus of Fine Aggregate
 - .5 Clay Lumps and Light Weight Pieces
 - .6 Test for Organic Impurities in Fine Aggregate
 - .7 Flat and Elongated Particles in Coarse Aggregates
 - .8 Petrographic Analysis of Coarse Aggregate (PN-NSTIR Test Method-2)
 - .9 Resistance to Degradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles machine
 - .10 Micro-Deval test for Coarse and Fine Aggregate
 - .11 Soundness of Coarse and Fine Aggregate by Use of Magnesium Sulphate
 - .12 Test for Detection of Alkali-Aggregate Reactivity (AAR) on Coarse and Fine Aggregate
 - .13 Unconfined Freeze and Thaw test

- .5 Submit two (2) weeks prior to commencement of the project adequate details of all equipment to be used. Equipment shall include that required for transporting, handling, placement and curing of all concrete.
- .6 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 – FIELD QUALITY CONTROL.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Departmental Representative, minimum of four (4) weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .3 Minimum four weeks prior to starting concrete work, submit proposed quality assurance procedures for review by the Departmental Representative on the following items:
 - .1 Falsework erection
 - .2 Hot weather concrete
 - .3 Cold weather concrete
 - .4 Placement method(s)
 - .5 Curing
 - .6 Finishes
 - .7 Formwork Removal
- .4 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 – PRODUCTS.
- .5 Health and Safety Requirements: undertake occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to by Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
- .2 The concrete materials shall be mixed and transported in a manner which will not segregate or damage the mix in any fashion. Concrete shall be mixed using stationary or truck mixers. The mixer shall carry the Manufacturer's rating plate in a prominent position that indicates the following:
 - .1 The gross volume of the mixer
 - .2 The rated maximum mixing capacity
 - .3 The minimum and maximum speeds for mixing and agitating of the mixer

- .3 The mixer shall be capable of combining the concrete ingredients into a thoroughly mixed and uniform mass and shall not exceed the capabilities of the mixer.
- .4 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .5 Where ready mix trucks are used to transport the concrete, the Departmental Representative reserves the right to subject any truck suspected of poor mixing to a uniformity test as outlined in CSA A23. If the truck fails the test, then the concrete and the truck shall be rejected at the sole cost of the Contractor unless otherwise directed by the Departmental Representative.
- .6 Contractor to provide copy of all delivery slips for concrete delivered and accepted at the site. Delivery slips to include all pertinent information including; supplier, date and time of dispatch, mix proportions, name and quantity of admixtures, batch quantity, etc.
- .7 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .2 Use trigger operated spray nozzles for water hoses.
 - .3 Carefully coordinate the specified concrete work with weather conditions.
 - .4 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.
 - .5 Designate an appropriate area on the job site where concrete trucks and tools can be safely washed to limit water use and runoff.
 - .6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, provincial and national regulations.
 - .7 Choose least harmful, appropriate cleaning method which will perform adequately.

Part 2 Products

2.1 MATERIALS

- .1 All cementing materials to CSA A3001.
- .2 Cementing material to be a blended Portland cement, fly ash, silica fume cement, Type GUb F/SF. The minimum proportion by mass of the total cementing materials for silica fume shall be 6% and a maximum of 8%. The maximum proportion by mass of the total cementing material for fly ash is 25%.
- .3 Water: to CSA A23.1 and to be free from injurious amounts of oil, acid, alkali soluble chloride, organic matter, sedimentation and other deleterious substances.
- .4 Aggregates: to CSA A23.1/A23.2. The maximum Petrographic Number of course aggregate shall not exceed 135. The maximum absorption of course aggregate shall not exceed 2%.

- .5 Coarse aggregates shall consist of washed crushed stone having a nominal size of 20 mm. The maximum combination of flat, elongated and flat and elongated particles, as defined in CSA A23.2, shall not exceed 10% of the total mass.
- .6 Fine aggregate shall be washed and classified for conform to the gradation limits specified in CSA A23.1.
- .7 The use of Alkali-Silica Reactive Aggregates shall not be permitted. When tested in accordance with CSA A23.2-14A, the expansion of the test samples incorporating the aggregate source shall not exceed 0.04 percent at one year.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
 - .1 Compressive strength: 50 MPa at 28 days.
 - .2 Consistency:
 - .1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 seconds.
 - .2 Flowable: to ASTM C827. Flow tables, 5 drops in 35 (ASTM C109, applicable portion) as to 145%.
 - .3 Plastic: to ASTM C827. Flow table, 5 drops in 35 (ASTM C109, applicable portions) 100 to 125%.
- .9 Curing compound: to ASTM C309, Type 2.
- .10 Isolation Joint filler:
 - .1 Bituminous impregnated fibre board: to ASTM D1751.
- .11 Joint Sealant: acceptable products include:
 - .1 For horizontal joints: two component polyurethane self-leveling elastomeric sealant.
 - .2 For vertical joints: polyurethane non-sag elastomeric sealant.
 - .3 Primer to be compatible with sealant.
- .12 Dampproofing:
 - .1 Emulsified asphalt, mineral colloid type: to CAN/CGSB-37.2.
- .13 Polyethylene film under approach slabs: 2 sheets each 6 mils thick, to CAN/CGSB-51.34.
- .14 Precast concrete toppers on top of decorative crash blocks: fabricated as per the Contract Drawings, CAN3-A23.4, with 32 MPa concrete and 6% air.

2.2 MIXES

- .1 Mixture proportions shall be selected on the basis of a 75 year design life and all concrete in the structure shall have a minimum compressive strength of 45 MPa in 28 days, unless noted otherwise on the Contract Drawings. The Contractor shall perform all tests required to demonstrate the long term performance and durability of the materials and concrete mixtures.
- .2 Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CAN/CSA A23.1/A23.2 and CSA S6.

- .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 – FIELD QUALITY CONTROL.
- .2 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative #1 to give the following properties for concrete in girder bearing plinths, precast concrete topper for pilasters and approach road drain (baffle drain):
 - .1 Minimum compressive strength at 28 days: 35 MPa.
 - .2 Class of exposure: C1.
 - .3 Chemical admixtures: type as approved and in accordance with ASTM C494.
 - .4 Normal size of aggregate: 20mm.
 - .5 Maximum water to cement ratio: 0.45.
 - .6 Minimum cementitious content: 350 kg/m³.
 - .7 Air content: 6 ± 1%.
 - .8 Slump: 80 ± 20mm.
- .3 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative #1. High Performance Concrete in bridge decks, curbs, abutments, wingwalls, approach slabs, pilasters shall be proportioned using Portland cement, Type SF silica fume, fine and coarse aggregates, air entraining, water reducing, and/or set regarding admixtures. Concrete mixtures shall be designed to meet the following:
 - .1 Minimum compressive strength at 28 days: 45 MPa.
 - .2 Design life of 75 years.
 - .3 Class of exposure: C1.
 - .4 Chemical admixtures: type as approved and in accordance with ASTM C494.
 - .5 Normal size of coarse aggregate: 20 mm.
 - .6 Maximum water to cement ratio: 0.35.
 - .7 Cementitious content: minimum 420 kg/m³, maximum 480 kg/m³.
 - .8 Air content: 6 ± 1% (7 ± 1% with superplasticizer).
 - .9 Maximum slump before superplasticizer: 60mm.
 - .10 Slumps after superplasticizer: 180 ± 30mm.
 - .11 Maximum spacing factor of hardened concrete not to exceed 230 µm.
 - .12 Chloride ion permeability at 56 days: <1000 coulombs.
 - .13 Maximum concrete temperature (from delivery equipment):
 - .1 Thickness >2 metres: 18°C.
 - .2 Thickness <2 metres: 25°C.
 - .14 Maximum concrete temperature (in situ): 70°C.
 - .15 Maximum temperature gradient: 20°C/metre.
 - .16 Superplasticizer shall be used in all concrete.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete. Provide 24 hours minimum notice prior to placing concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after review of equipment and mix by Departmental Representative.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Remove all debris including sawdust, chips and any other deleterious materials from the interior of the forms.
- .11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 CONSTRUCTION

- .1 Perform cast-in-place concrete work to CSA A23.1/A23.2.
- .2 High performance concrete shall not be placed when the air temperature exceeds 25°C or is likely predicted to rise above this temperature during placement. The temperature of the formwork, reinforcing steel or other material on which the concrete is placed shall not exceed 25°C.
- .3 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through structural members, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated must be reviewed by Departmental Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
 - .5 Check locations and sizes of sleeves and openings shown on drawings.

- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .4 Anchor bolts:
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 Coordinate with bridge barrier manufacturer (barrier post anchor bolts) and steel girder fabricator (bridge girder anchor bolts at each abutment) prior to setting anchor bolts.
 - .3 Locate anchor bolts used in connection with bridge barriers with due regard to ambient temperature at time of erection.
 - .4 When setting anchor bolts, care shall be taken to not only ensure that the anchor bolts are set in the correct position and orientation, but also that sufficient thread extension is provided to facilitate bolting the assembly to the concrete, complete with compatible nuts and washers (plate washers where specified), as per the details on the Contract Drawings.
- .5 Placing of concrete:
 - .1 Contractor is responsible for the placing method used.
 - .2 Concrete shall be delivered to the point of final deposit in a manner satisfactory to the Departmental Representative using means and equipment which will prevent segregation or loss of materials.
 - .3 The size of section to be placed in one continuous operation shall be as detailed on the drawings or as directed by the Departmental Representative.
 - .4 Unless otherwise authorized by the Departmental Representative, forms shall be kept dry during the placing of the concrete until the concrete has reached initial set.
 - .5 Concrete shall be deposited in the forms in maximum lifts of 500 mm and in layers that are approximately horizontal and as close as practicable to its final position.
 - .6 Concrete shall not be moved horizontally with vibrators or by other methods which could cause segregation.
 - .7 Under adverse weather conditions the Contractor shall be prepared to provide suitable protection in order to prevent damage to concrete.
 - .8 Consolidation:
 - .1 All methods of consolidation shall be subject to the approval of the Departmental Representative.
 - .2 Concrete shall be consolidated thoroughly and uniformly by means of hand tamping, vibrators or finishing machines to obtain a dense, homogeneous structure, free from cold joints, voids and honeycomb.
 - .3 A sufficient number of vibrators shall be employed to adequately handle the anticipated rate of placement. The size and frequency of vibrators shall be as specified in CSA A23.1. A stand-by vibrator shall be available on the site at all times.

- .4 Internal vibrators shall be used wherever practicable. External type vibrators may be used where surfaces cannot be properly consolidated with the internal type alone.
- .5 Insertion of internal vibrators shall be made systematically at intervals such that the zones of influence of the vibrator overlap.
- .6 Extreme care shall be taken to ensure that the internal type vibrators do not displace the reinforcing steel or the forms. Vibrators shall have rubber or non-metallic vibrating heads.
- .9 Curing concrete:
 - .1 Concrete shall be protected from freezing, premature drying, high temperature and moisture loss for a period of time necessary to develop the desired properties of the concrete.
 - .2 Curing shall be applied to concrete as soon as possible without damaging or marring the surface.
 - .3 Curing compounds shall conform to ASTM C309 Type 2.
 - .4 All fresh placed and consolidated concrete shall be suitably protected from the elements and from defacement due to construction activities, traffic and vandals. The effects of direct sunshine, drying winds, cold, excessive heat and running water are particularly harmful. The concrete shall be protected by the use of adequate tarpaulins or other suitable material to completely cover, or enclose, all freshly finished surfaces.
 - .5 The curing time shall be as indicated in CSA A23.1 or this specification. Curing shall be achieved by one or more of the following:
 - .1 Burlap: Two layers of pre-soaked burlap shall be carefully laid on the surface as soon as the concrete has set sufficiently to support the mass of the burlap without marking the surface. Strips shall be overlapped 150 mm, secured to the surface and kept wet throughout the curing period. Burlap shall be free from holes or other substances that may have a deleterious effect on the concrete.
 - .2 Moisture Vapour Barrier: The Contractor shall provide an effective vapour barrier and prevent any flow of air between it and the concrete surface. Where polyethylene sheet is used, it shall be white opaque pigmented with a minimum thickness of 100 µm. The vapour barrier shall be secured to the surface and overlapped 150 mm.
 - .3 White Pigment Liquid Membrane: Curing compounds shall not be used on a surface where a bond is required for additional concrete. A curing compound may be approved by the Departmental Representative under certain circumstances where the application of moisture is impractical and where such compounds will not jeopardize the appearance of the concrete. Curing compounds shall be applied at the Manufacturer's recommended application rate. Curing compounds are not permitted on construction joints, surfaces requiring weatherproofing sealants or deck sections.

- .4 Water: All concrete bridge decks shall be cured with water unless otherwise directed by the Departmental Representative. Concrete exposed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placing. The water for curing shall be clean and free from any material which could cause staining or discoloration of the concrete. All freshly placed and consolidated concrete shall be suitably protected from the elements.
- .5 Prior to covering the deck with burlap, decks shall be cured by fogging. Fogging shall commence 20 minutes after initial screeding and shall continue until concrete reaches initial set to allow placement of the wet burlap. Curing must commence immediately to prevent cracking or drying of the surface.
- .6 Hot Weather Concreting (if approved by Departmental Representative):
 - .1 When the air temperature is at or above 25°C, or is likely to rise above 25°C within 24 hours, special measures, as detailed in CSA A23.1 shall be taken by the Contractor to protect the concrete from the effects of hot and /or drying weather conditions.
 - .2 The temperature of the formwork, reinforcing steel or the material on which the concrete is to be placed, shall not exceed 25°C. Concrete temperatures shall not exceed those specified in CSA A23.1, Table 16.
- .7 Cold Weather Concreting:
 - .1 When the mean air temperature is at or below 5°C or when the temperature is likely to fall below 5°C within 24 hours, the Contractor shall place, cure and protect concrete in accordance with CSA 23.1 and this specification.
 - .2 Concrete shall not be placed on or against any surface which is at a temperature less than 5°C. Snow and ice shall be removed before concrete is deposited on any surface.
 - .3 Calcium chloride or other de-icing chemicals shall not be used as a de-icing agent in the forms.
 - .4 If heating of the mix water and/or aggregates is approved for use, the charging cycle shall be altered to prevent flash setting of the concrete.
 - .5 Aggregates and water shall not be heated above 80°C. Water and/or aggregates heated to a temperature in excess of 40°C, prior to the addition of the cementing materials shall be approved by the Departmental Representative.
 - .6 All frozen lumps of aggregate shall be excluded from the mix.
- .10 Protection Classes:
 - .1 Protection and curing depends upon the outside temperature, the wind velocity, and the size of the concrete section.

- .2 Under normal circumstances the following methods of protection may be required to maintain the protection necessary for the conditions described.
 - .3 Heating of the mixing water and/or aggregates shall be required for all classes of protection.
 - .4 When the outside temperature during placing or during the protection period may fall below 5°C, adequate covering of all surfaces with tarpaulins or polyethylene sheets shall be provided.
 - .5 When the outside temperature during placing or during the protection period may fall below 0°C, all surfaces shall be covered with an approved insulating material, over which tarpaulins or polyethylene sheets are placed.
 - .6 When the outside temperature during placing or during the protection period may fall below -5°C, a complete housing of the concrete, together with supplementary heat, shall be provided. The Contractor shall ensure that heat is supplied uniformly around the concrete.
 - .7 For mass concrete, defined as minimum section dimension in excess of 2 m, the temperature gradient shall not exceed 20°C/m from the interior of the element to the exterior face.
 - .8 In thin sections, less than 2 m, the temperature differential from the interior to the exterior shall not exceed 20°C.
- .6 Finishing of Concrete:
- .1 Basic Treatment:
 - .1 Upon removal of formwork, concrete surfaces shall receive a water blast (minimum 3000 psi) to expose surface defects.
 - .2 All cavities, honeycomb, surface voids, bugholes (greater than 6 mm in diameter) and other deficiencies shall be patched with sand cement mortar of the same composition as that used in the concrete.
 - .3 Mortar shall be composed of cement, fine aggregate and water, proportioned and mixed as specified.
 - .4 When the proportioning of cement and fine aggregate is not specified, the mortar shall consist of one (1) part by volume of cement and two (2) parts of fine aggregate.
 - .5 The quantity of water used in mixing the mortar shall be sufficient to make it capable of being freely spread with the trowel.
 - .6 Mortar shall be mixed in quantities which can be utilized within 60 minutes.
 - .7 Mortar shall not be re-tempered or re-mixed with water after initial set.
 - .8 All bolts, ties, nails, or other metal not specifically required for construction purposes, shall be removed or cut back to a depth of 25 mm from the surface of the concrete unless otherwise directed by the Departmental Representative.
 - .9 The cavity shall be kept saturated for 60 minutes prior to the application of a latex bonding agent or neat cement paste.

- .10 The mortar shall be pressed or packed into the depressions so as to completely fill the cavity and then finished to match the adjacent surface.
 - .11 Fins, unsightly ridges, or other imperfections shall be chipped or rubbed off flush with the surface.
 - .12 Mortar patches in excess of 25 mm shall be applied in layers not exceeding 25 mm with a 30 minute interval between the placing of layers.
 - .13 The surface of the patch shall be textured equivalent to the adjacent concrete.
 - .14 Honeycomb areas or cavities over 25 mm in diameter shall not be repaired until inspected by the Departmental Representative.
 - .15 Where honeycombing has occurred in non-structural elements, the affected area shall be removed and filled with mortar as previously described.
 - .16 Where honeycombing has occurred in structural elements, the corrective method of treatment shall be carried out as directed by the Departmental Representative.
 - .17 All concrete and mortar shall be cured and protected in accordance with CSA A23.1.
- .2 Smooth Form Finish (considered all exposed concrete surfaces as outlined in Section 03 10 00 - Concrete Forming and Accessories):
- .1 A Smooth Form Finish shall be a uniform, high quality concrete which has been homogeneously placed and thoroughly compacted.
 - .2 A Smooth Form Finish shall be uniform in colour, pattern and texture. All exposed bridge components and curbs shall have a Smooth Form Finish.
 - .3 If the concrete, after form stripping and the basic treatment, does not exhibit such finish, the Contractor shall perform any or all of the following operations, in order to obtain a Smooth Form Finish:
 - .1 Cut out all corrodible metal within 25 mm of the surface and repair the cavities as indicated in basic treatment.
 - .2 Remove fins and other projections to leave a smooth, plan surface.
 - .3 Remove stains, rust marks or other blemishes which detract from the specified uniformity of appearance.
- .3 Sack-rubbed Finish (to be applied to concrete vertical faces of curbs, deck fascia and all surfaces of barrier pilaster following Basis Treatment and Smooth Form Finish):
- .1 The sack-rubbed finish shall be undertaken as soon as the surfaces are accessible.
 - .2 The concrete surfaces shall be thoroughly saturated with water and maintained wet for at least 1 hour before finishing operations are begun.
 - .3 All free water on the surface shall be removed prior to the application of the finishing mortar.

- .4 The mortar shall consist of one part (by volume) of cement to two parts (by volume) of clean sand passing a 630 um sieve and enough water so that the mixed mortar shall have a consistency of thick paint.
- .5 The mortar shall be preshrunk by mixing at least 1 hour before it is used and then remixing without the addition of water prior to its use.
- .6 The sand and cement shall be the same materials as those used in the concrete.
- .7 The mortar shall be rubbed thoroughly over the sections of the prepared concrete surfaces with clean burlap pads or other suitable materials so that all surface voids are filled.
- .8 While the application mortar is still plastic, the surfaces shall be rubbed with the sack pads, using a mixture of mortar of the same proportions as previously specified, except that no mixing water shall be used.
- .9 The final rubbing shall be performed in such a manner that the filled voids are left flush with the surface of the surrounding concrete.
- .10 The finished surface shall be cured continuously in accordance with this specification following completion of the finished surface.
- .4 Open Surfaces:
 - .1 The finished surface of concrete placed for such items as bridge decks, approach slabs, sidewalks and curbs shall conform to the lines, grades and elevations shown on the contract drawings.
 - .2 Concrete edges and expansion joints shall be formed in the concrete at the designated locations.
- .7 Damp-proof Membrane:
 - .1 All damp-proofing material shall conform to CAN/CGSB-37.2-M and shall be applied in accordance with CGSB-37.3. Provide damp-proofing technical specifications to the Departmental Representative for review four weeks before application.
 - .2 The back face of abutments and soil face of wingwalls where concrete will be in contact with backfill shall be damp-proofed.
- .8 Concrete Sealer and Coatings:
 - .1 Apply concrete sealers/coatings as described in Section 07 92 00 – Concrete Joint Sealant.
- .9 Placing and Finishing Concrete Bridge Deck:
 - .1 The finished surface of the deck concrete shall conform to grades and elevations shown on the Contract Drawings. Prior to placing deck concrete, the Contractor shall submit to the Departmental Representative detailed information on the method and equipment proposed for handling, placing and finishing of the concrete. The Contractor shall also demonstrate to the satisfaction of the Departmental Representative that all necessary adjustments have been made to provide the required camber, crown, slab thickness and concrete cover over reinforcement, prior to placement.
 - .2 Immediately prior to placement of deck concrete, the formwork shall be cleaned and thoroughly moistened. The Contractor shall also moisten the reinforcing steel

with water at the request of the Departmental Representative. Deck concrete shall be placed continuously until completion of the section. The placing sequence for continuous structures shall conform to the Contract Drawings.

- .3 Decks: The deck shall be finished using a mechanical screed machine followed by bullfloating and final texturing. Final finishing, texturing and curing shall be completed within 1.5 metres behind the screed machine. A work bridge (mobile catwalk) shall be used following the screed machine for bullfloating and finishing operations.
- .4 The finishing machine shall be self-propelled and travel on rails. It shall be fitted with a rotating cylinder screed, an adjustable powered screw auger and a vibrator mounted in front of the screed. It shall be capable of forward and reverse movement under positive control. There shall be provision for raising all screeds to clear the screeded surface without adjusting the legs. It shall also be provided with a locking device at each leg to prevent vertical adjustment. The finishing machine shall be capable of obtaining an acceptable surface texture without excessive additional hand finishing.
- .5 A work bridge riding on the screed rails behind the finishing machine with a working platform not higher than 0.4 m above the finished surface shall be provided to facilitate hand finishing work, concrete inspection, and placing of curing materials. On placements longer than 40 m or wider than 10 m, a second work bridge shall be provided. When two work bridges are required, the trailing work bridge shall ride on the screed rails and shall be used for the purpose of placing the curing materials and shall have sufficient clearance to allow for the proper placing of the curing materials. Screed rail chairs shall be adjustable in height and made of metal.
- .6 The finish deck surface shall be tight, smooth, free from ridges, depressions, undulations or blemishes. The surface shall receive a texture finish as indicated in Section 3.2.10.1 of this specification. The deck surface shall be such that when tested with a 3 m long straight edge placed in any direction, there shall not be a gap greater than 8 mm between the bottom of the straight edge and the surface of the concrete.
- .7 Areas which do not meet the required surface profile shall be clearly marked and removed by the Contractor at the Contractor's expense. The Contractor shall, as directed by the Departmental Representative:
 - .1 Grind down any areas higher than 3 mm but less than 10 mm.
 - .2 Remove and replace deviations exceeding 10 mm. The quality of the repair shall be equal to or greater than the adjacent concrete in the undisturbed slab.
- .8 If concrete placement in the bridge deck is carried out with pumps or cranes, the Contractor shall be required to have available on site, at all times during placement, a minimum of two pumps or cranes or combination thereof. Concrete placement in bridge decks shall not be permitted between December 1st and March 31st unless otherwise advised by the Departmental Representative.
- .9 The Contractor shall take appropriate measures required to minimize defects in the concrete. These measures include but are not limited to: installation of wind breaks, installation of shelters, covering and protection from premature drying, timing of placements, additional workforce, and/or equipment. Upon completion

of the work, The Departmental Representative will conduct a survey to determine the extent, if any, of defects present in the structure. The method of repair for defects identified, requiring remedial action, shall be dependent upon the location and extent of the defect. Defects identified may result in repair, or rejection and replacement.

- .10 The concrete shall be textured by means of a burlap drag, broom or approved alternative. Ensure that the finish on the deck surface is compatible with the waterproofing membrane chosen.
 - .11 There shall be no application of water or cement to the concrete surface for finishing purposes.
 - .12 Deck concrete shall be water cured as described in PART 3 - CONSTRUCTION. During freezing temperatures, water curing shall be terminated 12 hours to the end of the protection period.
- .10 Concrete tolerance in accordance with CSA-A23.1/A23.2, except as noted below:
- .1 Bridge Deck Thickness: No more than 6 mm, no less than 3 mm.
 - .2 For Level or Specified Grade in Deck and Approach Slab: 12 mm in 3 m for exposed area, 25 mm in 3 m for backfilled area.
 - .3 Cross-Sectional Dimensions: No more than 12 mm, no less than 6 mm.

3.3 CRACKS

- .1 All cracks 0.15 mm and greater shall be repaired within the warranty period, regardless of location, size or cause in accordance with the following methodology. Fine cracks are defined as less than 1 mm, medium cracks were 1 to 2 mm, and wide cracks were greater than 2 mm. Fine cracks identified for repair shall be filled with an approved low viscosity epoxy resin. The resin shall be applied by pressure injection or by gravity feed into the crack and allowing the sealant to be absorbed. A second application may be required, depending on the absorption and crack depth. The second application, if required by the Departmental Representative, shall be made as soon as possible after the first application has set. All use and placement of resin materials shall be in accordance with the manufacturer's written instructions. Wider cracks, as identified from the survey may require a higher viscosity resin for repair. The Contractor shall submit manufacturer's data for the proposed resin in this case for approval prior to use. Excess resin in the vicinity of the crack shall require removal by grinding and/or abrasive blast cleaning at the Departmental Representative's direction.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and Section 1.6, Quality Assurance, of this Section and submit report as described in PART 1 - SUBMITTALS.
 - .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .2 Carry out tests for slump, air content, compressive strength and temperature in conformance with CAN/CSA A23.1 and CAN/CSA A23.2
 - .3 Frequency of Testing as follows:

- .1 Air, Slump and Temperature: one test for each load of concrete until satisfactory control is established daily and rate of placement $> 35 \text{ m}^3$ per hour; then one (1) test for each three (3) loads of concrete. Satisfactory control is considered to have been established when tests on five consecutive loads or batches of concrete are within specification requirements.
 - .2 Concrete shall be tested for slump, air content and temperature prior to and after the addition of superplasticizer (if added on site). Testing shall be carried out at the point of discharge from the truck and as close as possible to the final deposit into the forms. Sufficient superplasticizer shall be added to produce the desired consistency and if added on site, the superplasticizer shall be mixed into the load a minimum of five minutes prior to retesting.
 - .3 Concrete shall also be randomly tested for air content and rapid chloride permeability (RCP) in the hardened state (minimum one test every 150 m^3 of the same class of concrete cast). The hardened air voids shall be tested at 7 days and the RCP shall be tested at 28 and 56 days. A minimum of two hardened air void and two RCP tests shall be conducted during the project, one near the start of concrete casting and one near the end of concrete casting.
 - .4 A set of three regular compressive strength cylinders shall be made for every 50 m^3 of concrete placed, or fraction thereof, or as directed by the Departmental Representative. In addition, for every regular set of three cylinders, two additional cylinders will be cast to be tested only if requested by the Departmental Representative for appeal purposes.
 - .5 The responsibility for casting any additional cylinders required for interim testing lies with the Contractor.
 - .6 Ensure there is no accelerated curing of concrete cylinders
- .2 The Departmental Representative shall have the right to sample and test all materials used in the mixture design and given access to the production facilities of the ready mix supplier. Materials failing to meet requirements to be immediately rejected.
 - .3 Ensure test results are distributed to all parties.
 - .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .5 Departmental Representative may take additional test cylinders as required. Cure cylinders on job site under same conditions as concrete which they represent.
 - .6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
 - .7 Inspection or testing by Departmental Representative will not relieve Contractor of his contractual responsibility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29.06 – Health and Safety
- .3 Section 01 45 00 – Quality Control
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .5 Section 03 10 00 – Concrete Forming and Accessories
- .6 Section 03 20 00 – Concrete Reinforcing
- .7 Section 03 30 00 – Cast-in-Place Concrete

1.2 EXECUTION

- .1 Except as noted herein, all work under this section shall be undertaken in accordance with Section 03 30 00 – Cast-in-Place Concrete.

1.3 PROTECTION OF STEEL GIRDERS

- .1 Prevent marking or staining of girders.
 - .1 Seal joints between deck formwork and steel members including interior girders and diaphragms to prevent leakage of cement paste or concrete.
 - .2 Use caulking, duct tape, Ethafoam, or other suitable means or material, to achieve seal.
- .2 If foreign material spills onto girders despite protection provided, clean off, wash, and sandblast contaminated areas and repair any and all damaged coatings, as reviewed by Departmental Representative.
- .3 If exterior surfaces of girders becomes stained or marked, repair steel coating in accordance with Section 09 97 19 Steel Coating.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 55 26 – Traffic Regulation
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 05 50 00 – Metal Fabrications
- .5 Section 09 97 19 – Steel Coating

1.2 REFERENCES

- .1 American Association for State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO Standard Specifications for Highway Bridges-17th Edition 2002.
- .2 American Society for Testing and Materials International (ASTM International)
 - .1 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.
 - .2 ASTM A490M-14, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).
 - .4 CAN/CSA S16-14, Design of Steel Structures.
 - .5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .7 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).
 - .8 CSA S269.1-16, Falsework and Formwork.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop drawing review by the Designer is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Designer approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of work.

- .3 Each drawing submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .4 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners, bracing and diaphragms, and welds. Indicate welds by CSA W59 welding symbols.
- .5 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.
- .6 Submit description of lifting attachments, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting structural steel (reference Part 3 of this Section for further details / requirements for erection of structural steel for bridge).
- .7 Falsework drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .8 The Contractor shall schedule 4 weeks (20 business days) for the detailed single review of the bridge girder shop drawings. This review time will start the following business day after the Contractor has submitted the shop drawings to the Departmental Representative. If additional reviews of shop drawings are required, then additional time beyond that scheduled for the initial review will be required and the time required for subsequent shop drawing reviews shall not be constituted in any way by the Contractor as a delay.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting four weeks prior to beginning on-site delivery / installation of girders between Departmental Representative, General Contractor, Site Superintendent, Steel Fabricator and Steel Erector to:
 - .1 Verify project requirements.
 - .2 Review erection and substrate conditions.
 - .3 Review engineered erection plan, traffic control / closure requirements, erection schedule, emergency measures planning, etc.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle to prevent damage.
- .2 Provide protective blocking for lifting, transportation and storing.
 - .1 Exercise care during fabrication, transportation and erection so as not to damage girders, bearing, etc.
 - .2 Do not notch edges of members.
 - .3 Do not cause excessive stresses.
- .3 Mark mass on members weighing more than 3 tonnes.
- .4 Ensure that no portion of steel comes into contact with ground.
- .5 Replace or repair (to the satisfaction of the Departmental Representative) any damaged or faulty components.
- .6 Provide Departmental Representative with delivery schedules minimum 7 days prior to shipping.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste material in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.7 QUALITY ASSURANCE

- .1 Preconstruction Testing:
 - .1 Provide suitable facilities and cooperate with inspection organization, Departmental Representative in carrying out inspection and tests required.
 - .2 Adequate time shall be allotted for in both the construction and fabrication schedules to allow inspectors to complete all inspections and tests required. The construction and fabrication schedules provided for review to the Departmental Representative at the start of construction shall designate inspection task items that clearly show the time allotted for inspections and tests. Time shall also be allotted in the schedules for the review of all shop drawings as outlined in this section.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel, excluding rolled angle, HSS members and masonry plates, CSA G40.20/G40.21, grade and types 350WT Category 2. This includes all box girder webs, flanges, stiffeners, gussets and splice plates.
- .2 As noted on the Contract Drawings, the box girder shall be considered a fracture critical member as per Section 12 of CSA W59-13 and Section 10 of CSA S6-14. More specifically, the bottom flange, lower 1300 mm portion of the girder web along the entire span, along with the bottom flange and web splice plates shall all be considered fracture critical components of the structure.
- .3 All rolled angle shapes, masonry plates: to CSA G40.21M Grade 350W.
- .4 All HSS members to ASTM A500 Grade C.
- .5 High strength Type 1 bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M upon approval by Departmental Representative. Bolt assemblies to be galvanized and then coated with two coats (one mid coat and one top coat; Reference Section 09 97 19).
- .6 Anchor bolts, washers and nuts: to ASTM A307, or better and galvanized.
- .7 Welding electrodes: to CSA W48 series. Filler metal shall be in accordance with Table 5-1 of Filler Requirements for Exposed Bare Applications of CSA-G40.21M, 350A, 350AT, 400AT and ASTM A242 and SEE Steels of the CSA W59 Specification.
- .8 Stud shear connectors: to CSA W59, Clause 6 and Appendix H.
- .9 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m².
- .10 Fabrication shall not commence prior to the review of shop drawings by the Departmental Representative. Any fabrication done without the reviewed shop drawings may be rejected. All steel fabrication shall be done in accordance with CSA S6, CSA W59 and in accordance with the reviewed shop drawings.

- .11 Workmanship and finish shall be of the best modern general practice in the bridge fabrication and construction industry. Stressing, flame cutting and planning shall be done carefully and accurately. Particular attention shall be paid to the neatness and uniformity of finish of all parts of the work exposed to view.
- .12 Structural steel components shall be transported in such a manner so as to avoid development of fatigue cracks and deformation. When the components are stored on the job site, they shall be placed on timbers so that they do not make contact with the ground and are supported to avoid fatigue cracking, deformation or over-stressing. They shall be stored in a location where they will not be subjected to damage or surface contamination.
- .13 Steel coatings: see Section 09 97 19 – Steel Coating.

2.2 SOURCE QUALITY CONTROL

- .1 Steel producer qualifications: certified in accordance with CSA G40.20/G40.21.
- .2 Provide Departmental Representative prior to fabrication, with two (2) copies of steel producer certificates, in accordance with CSA G40.20/G40.21.
- .3 Submit Departmental Representative two 2 copies of mill certificates for all steel and certified test reports for Charpy V-notch tests and NDT testing.
- .4 Provide suitable facilities and cooperate with inspection organization, Departmental Representative in carrying out inspection and tests required.
- .5 Adequate time shall be allotted for in both the construction and fabrication schedules to allow inspectors to complete all inspections and tests required. The construction and fabrication schedules provided for review to the Departmental Representative at the start of construction shall designate inspection task items that clearly show the time allotted for inspections and testes.
- .6 The acceptance criteria for all welding inspections shall be based on CSA W59, Section 12, Cyclically Loaded Structures.
 - .1 All welds shall be visually inspected. All full penetration welds, except those specified in webs, shall be 100% inspected by Radiographic or Ultrasonic methods. When welds are tested by the Ultrasonic method, spot Radiography shall be performed on 10% of those welds tested.
 - .2 All full penetration welds in webs shall be inspected by Radiographic or Ultrasonic methods for at least 25% of the weld length. The inspection shall be performed nearest the tension flange. If defects are identified, additional inspections shall be done to determine the extent of these defects. The bottom 1300 mm of web shall be considered the web tension zone for all sections of girders.
 - .3 Web-to-flange fillet welds shall be subject to magnetic particle inspection in accordance with the following:
 - .1 Submerged arc welds: 25 percent of length.
 - .2 Semi-automatic welds: 50 percent of length.
 - .3 Manual welds: 100 percent of length.
 - .4 Provide suitable facilities and cooperate with inspection organization and Departmental Representative in carrying out inspection and tests required.

- .4 Fillet welds for attaching gusset plates, diaphragms and stiffeners shall have 25 percent of the total weld length tested by magnetic particle inspection.
- .5 All gusset plates and stiffeners for attaching diaphragms and / or bracing shall be tested for 100 percent of the weld length, measured from the tension flange and up the web for 1300 mm from the bottom of the web.
- .6 The cost of additional inspection and testing made necessary by the Contractor's work not meeting these specifications shall be the responsibility of the Contractor.

Part 3 Execution

3.1 Erection

- .1 Clean steel surfaces as directed by Departmental Representative when staining or defacing occurs.
- .2 Verify location of substructure units, elevations of bearing seats and location of anchor bolts before erection of structural steel; report discrepancies to Departmental Representative.
- .3 Do not disturb river banks or embankment without prior written permission of Departmental Representative.
- .4 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes, and without distorting, kinking or sharply bending metal of any unit.
 - .1 Enlarge holes if necessary by reaming only after written approval from Departmental Representative.
 - .2 Reamed holes not to exceed size of bolt used by more than 2 mm.
- .5 Fabricate and install masonry plates as indicated. Do not fasten and grout masonry plates and anchor bolts into final position on beam seats until girders in place and properly aligned.
- .6 Place anchor bolts at elevations and locations indicated. Ensure sufficient thread extension provided to completely install washers and nuts as detailed on the contract drawings.
 - .1 Protect holes against entry of water and foreign material.
 - .2 Provide heating and protection as directed by Departmental Representative and completely fill space around anchor bolts and beneath masonry plate with non-shrink grout.
 - .3 Oversized galvanized corrugated sleeves for anchor bolts provided for fit-up / relative tolerances between as-built girder and foundations. It is the Contractor's responsibility to ensure that the foundations and girders are constructed within the tolerances provided such that the masonry plates and anchor bolts can be installed without the need to enlarge holes or bend anchor bolts.
 - .4 The annulus between the anchor bolts and corrugated sleeves, as well as the entire bearing surface beneath the masonry plates shall be completely grouted after the girder is in place and adjusted in its final position. The grout shall be flowable non-shrink grout with strength of 50 MPa after 28 days. The deck shall

not be cast until the grout beneath the masonry plates has reached 50 MPa. A high early strength grout can be used for this application. Technical specifications for the grout shall be forwarded for approval to the Departmental Representative at least 10 working days before use.

- .5 Submit details of installation and methods of support to Departmental Representative for review prior to commencing protection work.
- .7 The fabricator shall erect the whole of the fabricated structural steel work supplied under the Contract. The Contractor shall supply all materials, tools, equipment, plant and labour necessary for the erection of the steel work. The fabricator shall erect the structural steel in accordance with the requirements of the ASHTO specification and CSA-S6 specifications. Included in this scope of work is the setting of the girder into its final position, the installation of the anchor bolts and the full grouting of the anchor sleeves and bearing surfaces beneath the masonry plates.
- .8 Due to the nature of the highway as a critical transportation link and the lack of detour routes available for emergency vehicles, the method of erection of the steel girders is provided as part of the Contract Drawing package in the EP drawings series. The erection method generally involves transporting the steel box girders across the existing bridge structure and lifting the girder from the transporter and placing it onto the new abutment bearings using cranes located behind each new abutment.
 - .1 The transporter axle and load arrangement is defined on the Contract Drawings. The existing bridge structure has been analysed and assessed to have adequate capacity to resist and transmit the loading resulting from the transporter arrangement detailed on the Contract Drawings. The Contractor shall submit details of the girder transporter, including axle spacing and axle loading, to the Departmental Representative four (4) weeks prior to girder erection. The girder erection shall not proceed until approval is granted in writing by the Departmental Representative. Equivalent transporter arrangements may be considered provided the axle spacing and resulting loads are no worse than those indicated on the Contract Drawings. The transporter submittal shall include:
 - .1 The axle spacing of the Dolly, Jeep, and Truck and the geometry of the girder support locations on the transporter.
 - .2 The actual self-weight axle loads for the Dolly, Jeep, and Truck. The self-weight axle loads shall be determined by a weigh scale and be representative of the condition the transporter will be in when transporting the girder across the bridge (fuel weights, support structure etc).
 - .3 The theoretical axle loads with the girder loaded on the transporter (using the measured self-weight axle loads and the theoretical girder weight).
 - .2 Should the Contractor's preferred transporter load and axle configuration result in a more severe arrangement than what is illustrated on the Contract Drawings, the Contractor shall follow the requirements for girder erection alternates outlined in Clause 3.5 of this Section.
 - .3 The Departmental Representative shall inspect the girder placement on the transporter for conformance with the Contract Drawings prior to the transporter crossing the existing bridge.

- .4 Crane sizes and locations have been provided in the Contract Drawings to accommodate the maximum anticipated lift radius and loading for the girder erection. Cranes are located behind the new north and south abutments at prescribed offsets to avoid surcharging the new abutments. The Contractor shall submit crane details, including lift plans, to the Departmental Representative four (4) weeks prior to the girder erection. The girder erection shall not proceed until approval is granted in writing by the Departmental Representative. Equivalent cranes to those listed on the Contract Drawings may be considered provided the following criteria are met:
 - .1 The crane can achieve the same capacity for the maximum radius listed on the Drawings (or better),
 - .2 The minimum outrigger offset from the new abutment and top of slope is maintained, and,
 - .3 The resulting outrigger reactions are no greater than those stated on the Drawings.
- .5 Should the crane size, location, and/or outrigger loads differ from what is illustrated on the Contract Drawings, the Contractor shall follow the requirements for girder erection alternates outlined in Clause 3.5 of this Section.
- .6 The Departmental Representative shall review the final crane placement for general conformance with the Contract Drawings prior to commencing girder lifting operations.
- .9 It is imperative that the existing bridge remain in service and be capable of carrying two lanes of undivided two way traffic throughout construction until such point as when traffic is diverted onto the new bridge and realigned approaches. The only exception to this is as outlined in Clause 3.1.11, below.
- .10 A post erection condition survey shall be completed after each girder is erected by the Departmental Representative. The existing bridge may be re-opened to two lanes of traffic once the Departmental Representative is satisfied that no changes to the existing bridge condition have occurred as a result of the girder transport.
- .11 The following outlines the permissible closures of the existing bridge throughout construction.

A single lane closure on the existing bridge is acceptable during each girder erection. During each single lane closure, the Contractor is responsible to develop and execute a traffic control plan for the single lane of alternating traffic. The timing of the single lane closure and its duration shall be approved by the Departmental Representative.

Both lanes of the existing bridge may be closed for a total of two separate 20 minute closures during each of the two allotted single lane closures to complete the girder erections (40 minutes total per single lane closure). The first 20 minute closure is allotted for transport of the girder across the existing structure to the final position for crane lifting. The second 20 minute closure is allotted for lifting the girder from the existing bridge onto the new abutments. Both lanes of traffic on the existing bridge shall be closed during girder lifting operations where the girder is located within three (3) meters of the footprint of the existing structure. A single lane of alternating traffic shall be reinstated when the lifted girder is an acceptable distance away from the existing bridge. Two lanes of traffic shall not be reinstated until the Departmental Representative has observed the condition of the existing bridge following the girder erection (refer to Clause 3.1.10).

The Contractor shall develop an emergency response plan that, should it be required, allow for uninterrupted access across the existing bridge for emergency response vehicles during each girder erection operation. The Contractor shall ensure the unobstructed passage of snow plows during the single lane closure. If the reduced single lane width does not permit the unobstructed passage of snow plows, the Contractor shall not erect the girders during a snow fall event when plows will be in operation.

- .12 The crane placement is detailed to avoid surcharging the new and existing foundations and slopes. The Contractor shall ensure all large machinery or secondary cranes or boom trucks are kept out of the influence zone of the abutments at all times unless otherwise approved by the Departmental Representative.
- .13 Infilling of Rocky Barachois (except as specified on the Contract Drawings) to complete the girder erection is considered unacceptable unless otherwise approved in writing by the Departmental Representative.
- .14 Permissible staging / laydown areas to prepare for the girder erection are as indicated on the AG Series Contract Drawings.

3.2 **INSTALLATION**

- .1 Do falsework in accordance to CSA S269.1, except where specified otherwise.
- .2 Do fabrication and erection of structural steel in accordance with CAN/CSA S6, Design of Highway Bridges and AASHTO Standard Specifications for Highway Bridges.
- .3 Do welding in accordance with CSA W59, except where specified otherwise.
 - .1 For CSA G40.20/G40.21, grade 350WT steel, deposited weld metal to have Charpy V-Notch value not lower than that of steel.
 - .2 Do welding in shop unless otherwise permitted by Departmental Representative.
 - .3 Weld only at locations indicated.
- .4 High strength bolting: in accordance with CAN/CSA S6 and CAN/CSA S16. Use 'turn-of-nut' tightening method to bring bolts to the slip critical condition.
- .5 Finish: members true to line, free from twists, bends, open joints, sharp corners and sharp edges.
- .6 Allowable tolerance for bolt holes:
 - .1 Matching holes for bolts to line up so that dowel 2 mm less in diameter than hole passes freely through assembled members at right angles to such members.
 - .2 Finish holes not more than 2 mm in diameter larger than diameter of bolt unless otherwise specified by Departmental Representative. Holes shall be drilled (not punched) at all locations unless otherwise approved.
 - .3 Centre-to-centre distance between any two holes of group to vary by not more than 1 mm from dimensioned distance between such holes.
 - .4 Centre-to-centre distance between any two groups of holes to vary not more than maximum of the following:

Centre-to-Centre distance in metres	Tolerance in plus or minus mm
less than 10	1
10 to 20	2
20 to 30	3

- .5 Correct mispunched or misdrilled members only as directed by Departmental Representative.
- .7 Span length tolerances:
 - .1 Girders and beams: plus or minus 6 mm
 - .2 Centre-to-centre of bearing stiffeners and bearing plates: plus or minus 3 mm.
- .8 Girder support requirements:
 - .1 Support top and bottom flanges of ends of girders. Temporary bearing supports to be located at centerline of bearing points (longitudinally) directly beneath centerline of webs (transversely).
 - .2 Install girder flat and smooth except as otherwise indicated.
 - .3 As noted on drawings, bearing stiffeners fabricated to be plumb in the longitudinal direction after all dead loads applied. In the transverse direction, stiffeners to follow 4% superelevation.
 - .4 Do not machine or grind flanges of girders to correct irregularities unless permitted by Departmental Representative.
- .9 Shop splices:
 - .1 Use complete joint penetration groove welds finished flush.
 - .2 Details of butt joints to CSA W59.
 - .3 Use only as approved by Departmental Representative.
- .10 Camber:
 - .1 Camber tolerances for box girders to be to CSA W59.
 - .2 Record measurements of camber of each girder, at points indicated.
 - .3 Fabricate field splices to conform to required camber.
 - .4 Submit diagram to Departmental Representative showing camber for each girder fabricated.
 - .5 Advise Departmental Representative immediately when camber of fabricated girder is not within specified tolerances.
 - .6 Submit proposal for corrective measures.
 - .7 Do not undertake remedial measures until proposal has been approved by Departmental Representative.
 - .8 Verify stud length requirements based on as-built girder cambers and as-built top of girder elevations along span. All remedial measures to deal with as-built cambers / as-built girder elevations are the responsibility of the Contractor, including the engineered remediation plan and the detailed review of the plan. A detailed survey of the girder profiles and elevations shall be conducted by the contractor immediately after girder erection. The electronic survey file shall be forwarded in Auto CAD format to the Departmental Representative for review. Do not proceed with setting deck formwork elevations until the review of the as-built girder cambers / elevations is complete.
- .11 Shop erection:
 - .1 Support each girder on its bearing points and measure and record deflection at same points indicated for measurement of camber.

- .2 Measure vertical and translational deflections at the top flange to web intersection points at the stations detailed on the Contract Drawings. .
- .3 Submit diagram to Departmental Representative showing deflection measurements for each girder before delivery.
- .4 Shop erection is not required for single span girders with no field splices.
- .12 Field splices: as indicated on drawings. Additional splices to approval of Departmental Representative.
- .13 Mark members in accordance with CSA G40.20/G40.21.
 - .1 Do not use die stamping.
 - .2 Place marking at locations not visible from exterior after erection.
- .14 Match marking: shop mark field splice components.
- .15 All bolts to be detailed and installed with threads excluded from shear planes.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of steel.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Ensure manufacturer's representative is present before installation, during critical periods of installation and during torqueing of all bolted connections.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 GIRDER ERECTION ALTERNATE

- .1 **The girder erection design is provided as part of the Contract Drawings. Any deviations from the methodology and/or equipment noted on the Contract Drawings must be approved by the Departmental Representative in writing.**
- .2 **The Contractor shall submit the alternate girder erection Engineer's CV to the Departmental Representative for approval prior to submitting the alternate girder erection plan(s).**

- .3 The Professional Engineer responsible for the alternate girder erection design shall have the following qualifications:**
 - .1 Professional Engineering licensed to Practice in the Province of Newfoundland and Labrador.**
 - .2 Carry errors and omissions insurance with a coverage of at least 5 million dollars. Proof of insurance shall be provided to the Departmental Representative.**
 - .3 Shall have a minimum of ten (10) years design experience in bridge and erection engineering.**
- .4 The Contractor shall submit fully detailed proposed alternate girder erection plan(s) stamped by a Professional Engineer Licensed to Practice in the Province of Newfoundland and Labrador to the Departmental Representative for review at least eight (8) weeks prior to the start of girder erection. This review is for general conformance only and in no way limits the responsibility of the Contractor who shall remain fully responsible for the design of any alternate girder erection plans. The alternate erection design shall be undertaken in accordance with CAN/CSA S6. Approval for any alternate girder erection plan must be gained after a maximum of two rounds of submittals by the Contractor otherwise the Contractor shall erect the girders as originally detailed in the Contract Documents. Approval of any alternate girder erection plan must be gained at least four (4) weeks prior to the start of girder erection. If approval is not granted in this time frame, the Contractor shall continue with the girder erection as originally detailed in the Contract Documents. The Contractor shall make no claim for delays associated with failure to gain approval of an alternate girder erection plan.**

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 30 00 – Cast-in-Place Concrete
- .4 Section 05 12 33 – Structural Steel for Bridges
- .5 Section 09 97 19 – Steel Coating
- .6 Section 34 71 15 – Metal Traffic Barriers and Metal Railings for Structures

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA-S16-14, Design of Steel Structures.
 - .4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
 - .7 CSA S6-14, CSA S6 Canadian Highway Bridge Design Code (CHBDC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

- .2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.
- .3 Indicate materials, all necessary geometric details, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .4 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.
 - .1 Provide valid Canadian Welding Bureau certification of each welder and welding operator for the positions and processes intended.

1.4 QUALITY CONTROL

- .1 Test Reports: submit fabricator's certified quality control test reports showing compliance with approved shop drawings, specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials from damage.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: as much as possible, remove for reuse by manufacturer any pallets, crates, padding and packaging materials.

1.6 Waste Management Disposal

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

Part 2 Products

2.1 MATERIALS

- .1 Steel plates, and armour angles: to CSA G40.20/G40.21, Grade 350W.
- .2 All HSS members to ASTM A500 Grade C.
- .3 Membrane drain pipes to ASTM A53, or better.

- .4 Welding materials: to CSA W59.
- .5 Welding electrodes: to CSA W48 Series.
- .6 High strength Type 1 bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M upon approval by Departmental Representative. Bolt assemblies to be galvanized.
- .7 Anchor bolts: to ASTM A307 or better.
- .8 Stud shear connectors: to CSA W59, Clause 5.5.6 and Appendix H.
- .9 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m².
- .10 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours, 50 MPa at 28 days.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Where possible, fit and shop assemble work, ready for erection.
- .3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .4 All items under this Section to be hot-dipped galvanized.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 763 g/m² to CAN/CSA-G164.
- .2 For the galvanized membrane drains, care shall be taken to ensure that the rim of the bolt holes drilled in the girder web for the drain connection bracket is coated with the project specified high-performance three coat system. This coating is required to avoid galvanic reaction between the steel girder and the galvanized drain connection bracket / bolt.

Part 3 Execution

3.1 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metal work square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CSA-S6, or weld.
- .7 Hand items over for casting into concrete to appropriate trades together with setting templates.

- .8 Touch-up damaged galvanized surfaces with zinc rich primer where burned by field welding.
- .9 Install items as per Contract Drawings / Approved Shop Drawings.

3.2 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt. Cleaning to meet approval of Departmental Representative.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 32 12 16 – Asphalt Paving
- .3 Section 32 12 13.16 – Asphalt Tack Coat

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 37-GP-9Ma-[83], Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing.
 - .2 CAN/CGSB-37.50-M89, Hot Applied, Rubberized Asphalt for Roofing and Waterproofing.
 - .3 CAN/CGSB-37.51-[M90], Application for Hot-Applied Rubberized Asphalt, for Roofing and Waterproofing.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Latest edition of Manufacturer's literature including performance data and installation procedures.
- .3 A sample of the waterproofing membrane shall be tested and approved prior to incorporation into the Work.
- .4 Submit test results for the Water Absorption Test of the protection board one week prior to installation.
- .5 The Contractor shall give a minimum of 48 hour notice, in writing, prior to commencement of any waterproofing operations.
- .6 Copy of Applicator's certification issued by the manufacturer stating that the Applicator is a qualified installer of the manufacturer's system.

1.4 QUALITY CONTROL / QUALITY ASSURANCE

- .1 Protection Board: protection board shall be tested using the Water Absorption Test. Two specimens of protection board 150 mm x 50 mm shall be cut. The specimens shall be over dried to constant mass at 60 C +/- 1 C. The mass of the specimens before and after drying shall be recorded.
- .2 The specimens shall then be submerged horizontally under 25 mm of water three times as follows:

- .1 First immersion: the water temperature shall be $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and the duration of the immersion shall be 4 hours.
- .2 Second immersion: the water temperature shall be $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and the duration of the immersion shall be 20 hours.
- .3 Third immersion: the water temperature shall be $60^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and the duration of the immersion shall be 80 hours.
- .3 After each immersion the specimens shall be towel dried and the mass recorded.
- .4 The percent mass loss or gain from the original oven dry mass shall be recorded.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 The waterproofing membrane shall be supplied to the job site in cakes, in the Manufacturer's sealed and labelled containers, ready for melting and application.
- .3 The protection board shall be so packaged as to permit shipping, handling and storage without damage to the contents.
- .4 Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Departmental Representative or other personnel.

Part 2 Products

2.1 MATERIALS

- .1 Primer coat of concrete surface: liquid asphalt primer to CGSB 37-GP-9Ma.
- .2 Asphalt Waterproofing Membrane: Waterproofing membrane shall be a hot applied asphalt waterproofing membrane certified by the Manufacturer to conform to the requirements of CGSB 37-GP-50M.
- .3 Asphalt Waterproofing Membrane shall conform to the physical requirements listed in the following:

Test	Specification (mm)
Cone Penetration at 25°C	110 (max.)
Cone Penetration at 50°C	160 (max.)
Flow at 60°C	3 (max.)

Test results shall be submitted by the Contractor to the Departmental Representative one week prior to installation, however the Departmental Representative may take samples for testing at any time during the operation.

- .4 Protection Boards: shall be formed of asphalt and fillers between two sheet materials. The boards shall be uniform over its entire area to the thickness specified. The thickness of

the protection board shall be 3.6mm +/- 0.4 m. The width of the board shall be 1000mm +/- 150mm and the length of the board shall be 1500mm +/- 150 mm. The board shall have straight edges, square corners and edges free of burrs and breakaways. Notwithstanding the size tolerance stated, all sheets shall be of the same length and width with a tolerance of +/- 5.0mm and a uniform thickness with tolerance of +/- 0.25mm. The protection board shall have a water absorption of 5.0% maximum and shall show no deterioration or loss of mass during the Water Absorption Test.

- .5 Tack Coat for Protection Boards: tack coat for protection boards shall be RS-1 emulsion.

Part 3 Execution

3.1 GENERAL

- .1 All waterproofing operations shall be carried out when the air and concrete surface temperature are both 5⁰ C or higher.
- .2 The applicator shall be approved by both the Departmental Representative and the manufacturer of the waterproofing system.
- .3 Perform the work in strict conformance with the manufacturer's written instructions and this specification. In the event there is a discrepancy between the manufacturer's written instructions and this specification, the more stringent requirement shall apply. The Departmental Representative shall have sole discretion on these matters.
- .4 Perform all of the operations involved in waterproofing in sequential order, such that there are no delays between individual operations other than those necessary to meet the requirements of these specifications.
- .5 Drainage holes through the deck shall not be plugged by either waterproofing membrane, protection board or asphalt concrete.
- .6 Waterproofing operation shall not commence until the Departmental Representative has approved the preparation work.

3.2 SURFACE PREPARATION

- .1 Concrete surface to be completed treated by abrasive blast cleaning, or such method as approved by the Departmental Representative to ensure that sound, laitance-free concrete is exposed. If a curing compound had been used on the concrete surface, it shall be completely removed.
- .2 Check the flatness of the surface after surface preparation has been completed. Areas that do not meet a 3mm in 3 m planeness shall be ground by the contractor.
- .3 Sweep all dirt and debris off the surface and dispose of before applying tack coat. Immediately prior to the application of the tack coat, the concrete surface shall be cleaned with a jet of oil-free compressed air to remove all dust and foreign material.

3.3 PRIMER COATING OF PREPARED CONCRETE DECK

- .1 Apply a primer coat of Liquid Asphalt Primer to the prepared concrete surface at a rate of 0.25 L/m² with approved equipment which shall provide a uniform application at the

required rate. Primer coat shall be applied when concrete is dry and clean. Waterproofing equipment shall not be permitted upon the primer coat until it has fully cured.

3.4 APPLICATION OF ASPHALT WATERPROOFING MEMBRANE

- .1 Cakes of the waterproofing membrane shall be melted on the job site in a double boiler oil heat transfer type mechanical agitated heating and mixing kettle. The unit shall keep the contents continuously agitated until the material can be drawn free flowing and lump free from the mixing kettle at a temperature with the range recommended by the manufacturer. The kettle shall be equipped with functional permanently installed dial type thermometers to measure the temperature of the melted compound and the oil.
- .2 Waterproofing membrane shall not be applied until the tack coat has cured completely and is free of any surface moisture and dirt. Apply the waterproofing within the temperature range recommended by the manufacturer in the following sequence:
 - .1 Apply the waterproofing along the edge of the deck for the width of 300 mm and up the face of the curbs to the height of 80 mm. Apply the waterproofing along the joint between the deck and approach slab (two locations) for a width of 400 mm between curbs.
 - .2 Place a sheet of rubber membrane reinforcement (minimum 150 mm wide by 1.2 mm thick) up the face of the curbs at a height of 40 mm. Place a sheet of rubber membrane reinforcement (minimum 300 mm wide by 1.2 mm thick) at each joint between the deck and approach slab. Rubber membrane to be placed while the waterproofing is still sticky.
 - .3 Apply waterproofing over the rubber membrane reinforcement.
 - .4 Apply the waterproofing to the tack coated deck so as to form a uniform film having a thickness of 5 +/- 1 mm, unless otherwise specified and approved by the Departmental Representative.

3.5 APPLICATION OF PROTECTION BOARD

- .1 Place protection boards on the waterproofing membrane while the surface is still tacky with the length of the board transverse to the deck centerline. Materials or substances shall not be applied to remove the tackiness prior to installation of the protection board.
- .2 Protection boards shall be placed with edges overlapping 25 mm both longitudinally and transversely, unless otherwise approved by the Departmental Representative.
- .3 The protection board edge shall be within 6 mm of all curbs and drain verticals. Place protection boards such that the longitudinal (direction of traffic flow) joints are staggered a minimum of 150 mm.
- .4 The protection boards shall remain free from perforation when applied.

3.6 TACK COATING OF PROTECTION BOARD

- .1 Apply a tack coat of RS-1 emulsion at a rate of 0.14 L/m² or as directed by the Departmental Representative. Tack coat material shall be applied to the protection board with approved equipment which will provide a uniform application at the required rate. The tack coat shall be applied only when the protection board is dry, clean and when air

temperature is above 5 C. The tack coat shall be placed just sufficiently ahead of paving to allow for adequate curing.

3.7 PAVING OF BRIDGE DECK AND APPROACH SLABS

- .1 Place asphalt concrete paving of bridge deck and approach slabs within 48 hours of the completion of waterproofing or as otherwise directed by the Departmental Representative.
- .2 Place asphalt concrete without disturbing or damaging the waterproofing system. Immediately remedy any disturbance and / or damage to the waterproofing system before continuing with paving operations.
- .3 Within 24 hours of paving of the deck and approach slabs, seal the interface between the asphalt concrete and the face of the curb by pouring waterproofing along the joint such that the material extends 25 to 50 mm from the face of the curb and to a thickness of 2 to 4 mm above the asphalt concrete.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 NCHRP 244, Concrete Sealers for the Protection of Bridge Structures.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials to prevent damage to packaging.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor. Store coating products in temperatures above 4° C.

1.5 WASTE MANAGEMENT

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facility.
- .3 Unused coating material must not be disposed of into the river, on to the ground or in other locations where it will pose health or environmental hazard.
- .4 Divert unused coating material from landfill to official hazardous material collections site approved by Departmental Representative.

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations: conform to manufacturer's written instructions.
- .2 Substrate Conditions:
 - .1 Do not proceed with installation of materials until contaminants capable of interfering with penetrate are removed from substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of coatings including special conditions governing use.

Part 2 Products

2.1 MATERIALS

- .1 Concrete coating system shall be a solvent free, penetrating sealing compound of silane modified siloxane emulsion specifically formulated for concrete surfaces. The coating system shall be designed to reduce water and chloride penetration, providing a transparent finish appearance which will not degrade under UV exposure. Product to conform to the following parameters in accordance with NCHRP 244:

Permeability to Water Vapor	Water Vapor Transmission 100%
Water Absorption	Reduction in Water Absorption 91%
Rapid Chloride Permeability	Reduction in CL ion intrusion 90%

Part 3 Execution

3.1 APPLICATION

- .1 Apply concrete coating to the pilasters (all surfaces), tops and sides of curbs, outside edges of the bridge deck, soffit of the bridge deck from the girders' exterior flange lines to the outside edges of the bridge deck for the full length of the bridge. The coating shall also be applied to exposed surfaces of the wingwalls and abutments, projecting down 600 mm (min) below finished grades.
- .1 Do not apply if rain is imminent.
 - .2 Install to manufacturer's recommendations, but with an application rate of not less than 320 ml/m².
 - .3 Surface ambient temperature must not be less than 7°C or above 32°C during 24 hours after the application.
 - .4 Fresh concrete must be cured for 28 days prior to application.
 - .5 Finishing of concrete shall be in accordance with Section 03 30 00 prior to applying concrete coating.
 - .6 The concrete surface shall be dry and air blasted to remove dust prior to applying concrete coating.
 - .7 Concrete coating to be applied using a minimum of 2 coats.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 ASTM C719-14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
- .2 ASTM C793-05 (2010), Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.
- .3 ASTM C1193-13, Standard Guide for Use of Joint Sealants.
- .4 ASTM C1330-02 (2013), Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- .5 ASTM D412-06a (2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
- .6 ASTM D2240-05 (2010), Standard Test Method for Rubber Property – Durometer Hardness.
- .7 ASTM D5893/D5893M-10, Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.3 SUBMITTALS

- .1 Submit product data including printed product literature and data sheets in accordance with Section 01 33 00 – Submittal Procedures. Data to include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit sample for color selection.
 - .2 Submit sample for verification. Provide samples in color offered with joint sealants formed between two 150 mm long strip of material matching appearance of surfaces adjacent to joint sealants.
- .3 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Include preparation and installation instructions for each product used.
- .4 Submit standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to the project. Indicate width, width-to-depth ratio, thickness of joint sealant, and depth of recess limitations recommended by manufacturer.
- .5 Preconstruction field-adhesion test reports.

- .6 Field quality control adhesion test reports.

1.4 QUALITY ASSURANCE

- .1 Preconstruction Field-Adhesion Testing: Prior to installing pavement sealants, field test adhesion to joint substrates using ASTM C1193 Method A. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials to prevent damage to packaging.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.
- .3 Replace defective or damaged materials with new.

1.6 WASTE MANGEMENT DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .4 Divert unused joint sealing material from landfill to official hazardous material collections sites approved by Departmental Representative.
- .5 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic material destined for recycling.
- .6 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 PROJECT CONDITIONS

- .1 Environmental Limitations: conform to manufacturer's written instructions.
 - .1 Do not install silicone sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
 - .2 Do not install sealants when temperature is above 50° C or below 4.4°C.
 - .3 Do not install sealant when temperature is at or below dew point (the temperature at which the air is saturated with moisture vapor and liquid water (dew) begins to form).
- .2 Substrate Conditions:
 - .1 Do not proceed with installation of materials until contaminants capable of interfering with adhesion are removed from substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

- .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 Labour Canada.

- .2 Conform to manufacturer’s recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 MATERIALS

- .1 One-part, non-sag silicon material that cures to a low-modulus silicone rubber sealant designed for sealing joints in Portland cement concrete and accommodates typical thermal movements to the following requirements:

<u>Test Method</u>	<u>Test</u>	<u>Value</u>
As Supplied		
	Colour	Grey
ASTM D2202	Slump of Sealants	Pass (< 0.30 inches)
ASTM C1183	Extrusion Rate	90 – 250 g/min
ASTM C679	Tack Free Time	Pass (5 hours max)
ASTM C792	Heat Aging	3.05% loss max
ASTM C661	Durometer Shore A-2	15 - 25
ASTM C792	Specific Gravity	1.450 – 1.515
As Cured – 21 days at 25°C (77°F) and 50% RH		
ASTM D412	Ultimate Elongation	≥ 1200%
ASTM D412	Tensile Stress @ 150%	28 psi (45 psi max)
Performance		
ASTM C719	Movement, 10 cycles at +100/-50 percent	No Failure
ASTM C793	Accelerated Weathering at 5,000 hours	No cracks, blisters or bond loss

Part 3 Execution

3.1 JOINT SEALANT APPLICATION

- .1 Apply sealant to the following:
 - .1 Between approach slab and abutment back wall.
 - .2 Between approach slab and wingwalls
 - .3 Between bridge deck curb and curb on approach slab.
 - .4 At bridge deck curb joints

- .2 Examine joint profiles and surfaces to determine if work is ready to receive paving sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with paving sealant work once conditions meet sealant manufacturer's recommendations.
 - .1 Comply with width, width-to-depth ratio, thickness of joint sealant, and depth of recess limitations published by manufacturer for specific products.
- .3 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil, grease, and other matter which may impair Work using materials and methods recommended by sealant manufacturer.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.
 - .1 Remove laitance, form-release agents, dust, and other contaminants.
- .6 Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.
- .7 Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing. Apply recommended primer using sealant manufacturer's recommended application techniques. Allow to dry according to manufacturer's recommendations prior to sealant application.
- .8 Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of paving sealant allowing optimal sealant movement. Install continuously without gaps, twisting, stretching, or puncturing backing material. Use gauge to ensure uniform depth to achieve correct profile, coverage, and performance.
- .9 Apply sealant to manufacturer's instructions. Comply with recommendations in ASTM C1193.
 - .1 Tool non-sag type sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
 - .1 Provide concave, smooth, uniform, sealant finish. Eliminate air pockets and ensure complete contact on both sides of joint opening.
 - .2 Tool joints with one continuous stroke.
 - .3 Use tooling agents recommended by sealant manufacturer for application.
- .10 Curing: to manufacturer's recommendations.
- .11 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant without disturbing seal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D5329-09, Standard Test Methods for Sealant and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.
 - .2 ASTM D6690-12 (Type IV), Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS)
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

- .1 Submit product data including printed product literature and data sheets, in accordance with Section 01 33 00. Data to include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Include installation instructions for each product used.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials to prevent damage to packaging.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.
- .3 Replace defective or damaged materials with new.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

- .3 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.
- .4 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .5 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations: conform to manufacturer’s written instructions. Do not apply joint sealing material when the ambient temperature is below 2°C or according to the sealant manufacturer’s instructions.
- .2 Substrate Conditions:
 - .1 Do not proceed with installation of materials until contaminants capable of interfering with adhesion are removed from substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .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 Labour Canada.
- .2 Conform to manufacturer’s recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 MATERIALS

- .1 Sealants shall be a high performance, hot applied, single component, low modulus joint and crack sealant capable of undergoing thermal movements indicated on Contract Documents.
- .2 Sealant must exhibit low temperature bonding properties while still maintaining a high degree of resiliency to reject incompressibles.
- .3 Sealant shall permit high elongation at low temperatures with low stress development.
- .4 Sealant must have properties to prevent flowability out of the joint or from being picked up by tires of passing vehicles at high service temperatures.
- .5 Sealants to conform to the following requirements:

<u>PROPERTIES</u>	<u>TEST METHODS</u>	<u>SPECIFICATIONS</u>	<u>TYPICAL RESULTS</u>
Penetration @ 25°C 150G, 5 sec	ASTM D5329	90-150	120

Flow @ 60°C	ASTM D5329	3 MM MAX.	1.0
Bond at -29°C 200% ext – 1/2"	ASTM D5329	PASS 3 CYCLES	PASS
Resiliency @ 25°C	ASTM D5329	60% min	70%
Asphalt Compatibility	ASTM D5329	PASS	PASS
Ductility @ 25°C	ASTM D113		50 CM
Heat Stability 6 hours @ pouring temp.	ASTM D5329	PASS ALL REQUIREMENTS	PASS
Min softening point	ASTM D36	Min. 80°C	84°C

2.2 EQUIPMENT

- .1 Contractor shall supply all tools, machinery and equipment required in the execution of all phases of the work.
- .2 Routing and Cutting Equipment: The routing and cutting equipment shall be of a type which can expeditiously cut and form joint to the sizes specified. Be capable of continually creating well defined right angle routs. The equipment shall have cutter tools which are capable of cutting grooves 20 mm wide by 40 mm deep leaving the sides of the joint absolutely clean, smooth and ready for sealing.
- .3 Compressor: Compressed air equipment is required to effectively clean the routed joints. The compressor, which may be attached to the hot air lance, shall provide a clean oil-free air jet of a minimum flow of 4m³/min, a minimum velocity of 990 m/s and a minimum pressure of 600 kPa.
- .4 Hot Air Lance: Hot air lance is required to dry and pre-heat joints prior to applying sealing material. The hot air lance must be used at all times to warm the joint and remove moisture. It is acceptable to use the compressor and air lance simultaneously. Tiger torches are not permitted.
- .5 Heating Equipment for melting sealant:
 - .1 Double-jacketed melting boiler capable of providing indirect heating and constant agitation of the joint sealing material.
 - .2 Totally automatic temperature control system controlling both head transfer oil temperature and sealing compound temperature. Temperature controls will be capable of maintaining the temperature of the sealant within manufacturer's tolerances.
 - .3 Heated sealant applicator wand shall be attached to a heated hose and attached to a heated sealant chamber.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 PREPARATION

- .1 Rout joint to dimensions indicated on the contract documents.
- .2 Following routing, joint shall be cleaned with high compressed air free of oil to rid joint of debris and/or moisture.

3.3 JOINT SEALANT APPLICATION

- .1 Install asphalt impregnated fiber board beneath expansion joint system at approach end of each approach slab as indicated on Contract Documents prior to installing joint sealant.
- .2 Do not use sealant material that has been frozen.
- .3 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil, grease and other matter which may impair Work using materials and methods recommended by the low modulus sealant manufacturer.
- .4 Ensure joint surfaces are dry and frost free. Verify that conditions of substrate previously installed under other Section or Contracts are acceptable for pavement sealant application in accordance with manufacturer's written instructions.
- .5 Prepare joint sealant product in accordance with manufacturer's directions.
- .6 Prepare surfaces in accordance with manufacturer's directions.
- .7 Apply sealant to manufacturer's instructions.
 - .1 The joint sealing material shall be applied by heated sealant applicator wand. The sealing material shall be placed within two minutes after heating of the joint with the hot compressed air lance.
- .8 Curing: to manufacturer's recommendations.
- .9 Cleanup:
 - .1 Care shall be taken to avoid spillage of the material on the pavement. Should spillage occur, the contractor shall clean it up at his own expense.
 - .2 Clean adjacent surfaces immediately and leave Work neat and clean.
- .10 Prior to opening the area to traffic, all joints shall be thoroughly checked for areas exhibiting adhesion failure, damage to the sealant, foreign objects in the sealant or other problems. All areas not meeting the acceptable criteria shall be prepared and resealed until satisfactory.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 05 12 33 – Structural Steel for Bridges
- .3 Section 05 50 00 – Metal Fabrications

1.2 MEASUREMENT AND PAYMENT

- .1 Payment for this item shall be included in the contract unit price, lump sum, for Structural Steel for Bridges (refer to Section 05 12 33 – Structural Steel for Bridges).

1.3 REFERENCES

- .1 All reference standards in this section shall be current issue or latest revision at the first date of project tender advertisement.
 - .1 ASTM D269, Test Method for Insoluble Matter in Rosin and Rosin Derivatives.
 - .2 ASTM D4541, Test Method for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
 - .3 CGSB-GP-12C, Standard Paint Colours, Parts 1 of 3.
 - .4 CGSB 1-GP-171M, Coating, Inorganic Zinc.
 - .5 CGSB 1-GP-180Ma, Coating, Polyurethane, Two Package, General Purpose.
 - .6 CGSB 164-GP-IMP, Leachate Extraction Procedure.
 - .7 CSA-S269.2-M87, Access Scaffolding for Construction Purposes, the National Building Code of Canada.
 - .8 SSPC, (Steel Structure Painting Council), Steel Structures Painting Manuals – Volumes 1 and 2, “Good Painting Practice” and “Systems and Specifications”.
 - .9 SSPC PS 20.00, Zinc-Rich Primers.
 - .10 SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations.
 - .11 SSPC-Guide 7, Guide for the Disposal of Lead-Contaminated Surface Preparation Debris.
 - .12 NEPCOAT Qualified Products List A for Protective Coatings for New and 100% Bare Existing Steel for Bridges.
 - .13 CSA S6-14 Canadian Highway Bridge Design Code (CHBDC)

1.4 SUBMITTALS

- .1 Submit three (3) copies of the following in accordance with Section 01 33 00 – Submittal Procedures prior to the start of coating operations.
 - .1 Abrasive to be utilized along with manufacturer’s specifications.
 - .2 Coating(s) to be utilized along with the manufacturer’s specifications.
 - .3 Material Safety Data Sheets for all products. MSDS must remain at the place of work at all times.

- .4 Design of platform, scaffolds and enclosure stamped by a Professional Engineer registered in Newfoundland and Labrador.

1.5 QUALITY CONTROL

- .1 All material and equipment furnished and work done, shall be subject to inspection by the Departmental Representative. An appointed inspector may be on site during all operations. Such inspection shall not relieve the Contractor of the responsibility for furnishing the qualified labour, equipment, staging, etc., necessary to meet the requirements of this specification, or the safe accessibility to the work for the purposes of inspection.
- .2 The Contractor shall keep accurate records containing details such as weather, temperatures, dew points and times for the various coating applications and shall make these records available to the Departmental Representative upon request.
- .3 All work shall be subject to inspection by the Departmental Representative or appointed representative, who shall be given at least 48 hours notice prior to work commencing. The Contractor shall coordinate activities with the Departmental Representative to ensure that all aspects of the work are inspected. Defective work not conforming to this specification shall be repaired at no additional cost.
- .4 Methods of inspection and inspection procedures shall be as directed by the Departmental Representative, who shall govern both methods and standards. All findings will be recorded and will become part of the Project's Quality Assurance Records.
- .5 Coating inspection shall be performed in accordance with the procedures outlined in SSPC Manual, Volume 1, Chapter 5, "Inspection".
- .6 Profile measurements shall be made on a random basis by use of replica tape and spring micrometer or by micrometer depth gauge.
- .7 Dry film coating thickness readings shall be performed in accordance with SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages".
- .8 Testing of ambient and surface temperature and humidity shall be done by thermometer, surface thermometer and psychrometer with recognized psychrometric tables.
- .9 Destructive testing may be required where inadequate adhesion of the coating(s) is suspected. Adhesion testing shall be done in accordance with ASTM D4541. The minimum adhesion of the coating under evaluation shall be 1.7 MPa (250 psi). Coatings damaged as the result of destructive testing shall be repaired at no extra cost to the Contract. Repair procedures and materials shall be approved by the Departmental Representative prior to application.

1.6 DELIVERY OF PRODUCT

- .1 All coating materials shall be supplied in new condition. Two component coatings shall be packaged separately.
- .2 Coating components shall be packaged in proportions that are consistent with the manufacturer's normal method of packaging.
- .3 Each container shall bear a label which shall clearly show the manufacturer's name or brand of coating, the lot number and date of manufacture.

Part 2 Products

2.1 COATING SYSTEMS

- .1 Coatings applied to structural steel shall consist of:
 - .1 Inorganic zinc primer plus high build modified aluminum epoxy mastic mid-coat plus high build aliphatic polyurethane top coat in a selected colour. The top coat color shall be Jet Black (9005), approved by the Departmental Representative. Provide paint sample to Departmental Representative for approval prior to ordering coatings.
 - .2 Application of coating systems: the inorganic zinc primer shall be applied to the prepared metal surface by airless spray equipment or as recommended by the manufacturer. The inorganic zinc shall be applied at the shop. Application of the intermediate coat shall also be done in the shop. Application of the top coat may also be completed in the shop provided the Contractor repairs all damage due to transport, erection or construction activities and that the touch-ups blend with the shop applied top coat to provide a uniform, aesthetically pleasing end product. The appearance of the final product shall be of high quality and meet with the approval of the Departmental Representative. It is also acceptable to complete the entire top coating in the field at the end of construction provided proper enclosures and access for inspection agencies are provided. The Contractor shall repair all damage to the coatings prior to application of the top coating.
 - .3 Acceptable products: the contractor is responsible for ensuring that the latest formulation of the proposed coating products to be utilized in the work satisfies the requirements of this specification. Coating system must meet the requirements listed on the NEPCOAT Qualified Products List A for Protective Coatings for New and 100% Bare Existing Steel for Bridges. All coating work and systems for the purpose of this specification shall be considered a fully cured system prior to being accepted by the Departmental Representative. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval.

2.2 ETHYL SILICATE/POTASSIUM ZINC-RICH PRIMER

- .1 Inorganic zinc primer shall be a two-component self-curing type which, when mixed and applied in accordance with the manufacturer's instructions, cures without the use of a separate curing solution, and shall have the properties described herein. The inorganic zinc primer shall meet or exceed the requirements of Steel Structures Painting Council Specification PS 20.00 (Type 1).
- .2 Pigment: the zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 94% metallic zinc. All other fillers contained in the pigment shall be inert substances with an average particle size of 6 microns.
- .3 Vehicle: the vehicle components shall consist primarily of a partially hydrolyzed ethyl and or potassium silicate, in an appropriate hydrocarbon solvent. The storage life of the vehicle shall be nine (9) months minimum at 25°C.
- .4 Mixed coating: the total zinc portion shall be at least 84% by dry weight of the total solids of the dried coating. The coating shall tolerate up to 1% water contamination by weight without gelation, within five (5) minutes. The usable pot life of the mixed coating shall be not less than four (4) hours at 25°C. There shall be no hard settling which cannot be easily re-dispersed during this period.

- .5 Colour: the inorganic zinc coating shall be formulated so as to produce a distinct contrast in colour with the blast cleaned metal surfaces.
- .6 Primer coating shall be certified as a Class B coating for slip coefficient and creep resistance as per Appendix A of the ASTM A325 or A490 Bolt Specification. All faying surfaces shall be coated with the Class B primer coating as outlined in the ASTM A325 or A490 Bolt Specification. As such, all bolted connection faying surfaces shall receive the primer coating, including splice plates.

2.3 HIGH BUILD MODIFIED ALUMINUM EPOXY MASTIC

- .1 Coating shall be a self-priming, two-component, high build, aluminum filled epoxy mastic. The coating shall be compatible with inorganic zinc primers, catalyzed epoxies, catalyzed phenols or other coatings as recommended by the coating manufacturer. The coating shall also be compatible to be used over most generic types of coatings which are tightly adhering and properly prepared.
- .2 Solids by volume of the coating, when mixed, shall be 90 +/- 2% when tested in accordance with ASTM D269, total pigment by weight.
- .3 Pigment: the primary pigment shall be aluminum and shall represent a minimum of 17% of the total pigment by weight.
- .4 Mixed coating: the mixed coating must be capable of being top coated with most generic types of coatings after curing a minimum of 24 hours at 24°C. Final cure shall be attained after five days minimum at 24°C. The pot life of the mixed coating shall be a minimum of 4 hours when the material and ambient temperature are 24°C and the material has been thinned according to manufacturer's recommendations. The coating shall be capable of being applied when the material is at a temperature as low as 10°C.

2.4 HIGH BUILD ALIPHATIC POLYURETHANE FINISH COAT

- .1 High build aliphatic polyurethane finish coat shall be a two component, high solids, high build, spray applied coating with a satin or semi-gloss finish that is highly resistant to weather, abrasion, corrosive fumes, splash and spillage of acids, alkalies, solvents, salts and water. It shall provide adequate hiding when applied in a single coat directly over aluminum mastic and shall provide long term colour and gloss retention. The coating shall be compatible with inorganic zinc primers, catalyzed epoxies, catalyzed phenols or other overcoats, as recommended by the coating manufacturer. The coating shall also be compatible to be applied over most generic types of coatings which are tightly adhering and properly prepared.
- .2 Mixed coating: the two components of the system shall have a shelf life of 12 months minimum. The pot life for the mixed material shall be four hours at 24°C.
- .3 Finish coat colour to be Jet Black (9005), approved by the Departmental Representative. Provide colour chip to Departmental Representative prior to executing work.
- .4 Finish coat on girders shall be applied in the shop unless otherwise approved. All touch-ups carried out in the field are to be colour matched to the satisfaction of the Departmental Representative. If the touch-up colour match cannot be achieved, the Contractor is responsible to re-apply the entire finish coat in the field at their own expense.

- .5 All field coating activities shall be completed within an appropriate containment system to ensure that no materials fall or spill into the river or land area surrounding the structure.

2.5 BLAST MEDIA

- .1 Abrasive blast media shall be clean and sharp silica sand, washed industrial sand, steel grit, or a slag material of suitable size, weight and angular shape to produce the degree of cleaning specified and anchor pattern/profile required. The blast media shall contain no more than 1% by weight of water soluble solids. There shall be less than 10ppm oil in the abrasive and no trace of salts or toxic material. When cleaning by air blasting with sand abrasives, adequate separators and traps shall be provided to remove detrimental amounts of water and oil from the compressed air before it reaches the nozzle.
- .2 Materials unsuitable for use in the work shall be disposed of offsite in an approved manner at no additional cost to the Contract. Re-claimed abrasive material will not be acceptable with the exception of steel grit.

Part 3 Execution

3.1 GENERAL

- .1 Coating systems shall be as detailed in these specifications. The manufacturer's data sheets are part of this specification. Should there be any conflict between these two specifications, the decision of the Departmental Representative shall prevail.
- .2 All surfaces to be coated shall be free from contamination prior to any application. No coating work shall be done when the surface is less than 3°C above the dew point, nor when it is likely that there will be a change in the weather within four (4) hours of application that would be detrimental to the coating system. All coatings shall be uniformly applied without sags, foreign material, dust, contamination, cracks or other blemishes. Defects shall be removed and repaired to the satisfaction of the Departmental Representative.
- .3 The Contractor shall arrange for site visits from the coating manufacturer's technical representative a minimum of one visit per month while the job is in progress. For projects scheduled for completion in less than one month, the manufacturer's representative shall arrange to visit the site at least once. After each visit, the manufacturer's representative shall provide a written report to the Departmental Representative within 5 working days.
- .4 All coating work and systems for the purpose of this specification shall be considered a fully cured system prior to being accepted by the Departmental Representative. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval. No coating shall be applied when the wind speed exceeds 15 km per hour unless the Contractor can demonstrate to the Departmental Representative that adequate precautions have been made available which are acceptable to the Departmental Representative. The decision of the Departmental Representative shall be final.

3.2 SURFACE PREPARATION

- .1 All steel surfaces to be coated shall be abrasive blast cleaned in accordance with the requirements of SSPC-SP 10 "Near-White Blast Cleaning".

- .2 Equipment: abrasive blast cleaning equipment shall be of a quality and size sufficient to perform the work within the time available in the contract. Blast equipment must have adequate in line “driers” to ensure moisture is completely removed during blasting operations. All spray and blasting equipment must be adequately grounded to avoid build-up of static electricity. Detrimental amounts of water and oil shall be removed from any compressed air supply used for blast cleaning by means of appropriate functional traps, separators and heaters before the airstream reaches the nozzles.
- .3 All deposits of oil or greasy contamination shall be removed in accordance with SSPC-SP-1, “Solvent Cleaning” before commencing other surface preparation. Solvent wash solutions shall have prior approval.
- .4 Field coated surfaces shall be cleaned using high pressure fresh water wash to remove all sand, dirt, carbonation, salt and other contaminants. Enclosure shall be provided at this time if necessary to prevent wash material from entering the environment. Wash water shall be filtered through an approved filter medium (e.g., non-woven geotextile, minimum tensile strength 600 N, permeability 0.22 cm/sec) prior to discharge into the environment. Total maximum chloride contamination of any surface shall not exceed 30 ppm as tested using a standard SCAT kit. The high pressure wash shall start at the top and proceed down to the bottom of the steel. Special emphasis must be placed on corners and crevices where members are joined together. Solvent wash solutions shall have prior approval.
- .5 All weld splatter, slag, rust, burrs, slivers etc., shall be removed prior to coating in accordance with the requirements of SSPC-SP 2 “Hand Tool Cleaning” and/or SSPC-SP 3 “Power Tool Cleaning”. Any sharp edges, not in accordance with Good Painting Practices, shall be ground to produce a minimum radius of 4 mm. Corners and edges of flanges, stiffeners and bracing shall be broken on items which are to be coated. This work shall be approved by the Departmental Representative prior to blast cleaning.
- .6 Steel surface profile requirements shall be a minimum of 20% of the total film thickness specified, or as recommended by the coating manufacturer to achieve good coating adhesion and coverage.

3.3 FIELD DISPOSAL OF SPENT ABRASIVE

- .1 The Contractor is responsible for the removal and disposal of spent abrasive. All costs associated with the removal /disposal, sampling and leachate testing shall be the responsibility of the Contractor. No additional payment will be provided from the owner.
- .2 Spent abrasive material shall remain dry at all times in accordance with SSPC Guide 7.
- .3 Representative samples of the spent blasting medium containing coating chips and dust removed from the bridge will be taken by the Departmental Representative and submitted to a laboratory to be tested according to leachate test procedures in the CGSB provisional standard 164-GP-IMP. The abrasive must be kept in a water tight enclosure until the results of the tests are known in order to ensure that no contaminants are released into the environment.
- .4 If the leachate test results indicate the spent blasting medium is classified as a non-hazardous solid waste, then transport the medium from the project site to an approved waste disposal site at no additional cost to the Contract.

- .5 If the leachate test results indicate the spent blasting medium is classified as a hazardous solid waste, then transport the medium to a temporary storage location that has a fenced storage compound as approved by the Departmental Representative. Required loading and transportation charges shall be included in the Contract Price. Ultimate disposal of the stored material would then become the responsibility of the Departmental Representative.
- .6 Materials that qualify under the Dangerous Goods and Hazardous Wastes Management Act must be disposed of in a manner acceptable to the Newfoundland and Labrador Department of Environment and Conservation and as approved by the Departmental Representative.
- .7 All blast abrasive material shall be weighed before being delivered to site. The spent abrasive shall be weighed as it is removed from the site. Provide a weigh slip every two (2) weeks for all abrasive delivered to and removed from the site. A minimum of 90% of the abrasive used in the work shall be recovered.
- .8 No additional payment will be made due to delays in sampling and/or receiving leachate test results from the spent abrasive.

3.4 REPAIR OF DEFECTS

- .1 Before application of any further coat of material, all damage and/or contamination to previous coats shall be repaired to the approval of the Departmental Representative. In the case of repair, the procedures shall be in an acceptable manner as approved by the Departmental Representative. In the case of removal, the work shall be replaced by work and materials which shall conform to the specification. This clause shall have full effect regardless of the fact that the defective work may not have been previously identified by the Departmental Representative.
- .2 The Contractor shall supply repair and touch-up procedures which addresses the following:
 - .1 damage to all coats with steel exposed,
 - .2 damage to prime coat only,
 - .3 damage to the intermediate and top coat only, and
 - .4 damage to the top coat only.

3.5 ENVIRONMENTAL AND SAFETY CONTROLS

- .1 Protect and preserve the environment during the progress of the Work in conformance with the Guidelines for the “Application and Removal of Structural Steel Protective Coatings”, and applicable standards.
- .2 Provide protective enclosures and filters to contain dust or water in an effective manner and to minimize impacts from dust, water and coating particles entering the environment when washing or removing coating.
- .3 Ensure that waste materials, i.e., used coatings, solvents and refuse will not be disposed of in the aquatic environment, elsewhere on the highway or adjacent the right-of-way. Such material shall be disposed of according with applicable legislation.
- .4 All methods and materials for constructing the protective enclosure shall be in accordance with regulatory agency requirements having jurisdiction.

- .5 Materials collected or accumulated within the enclosure shall be removed and contained so as to prevent their escape. The collected material shall be disposed of off the site as indicated in Clause 3.3 herein.

3.6 PLATFORMS AND ENCLOSURES

- .1 Platforms and enclosures shall be provided by the Contractor where environmental protection is required, i.e., to protect the work piece or work place from the environment, or the environment from the work being performed. This shall include, but not be limited to, tents, heating or ventilating, negative air pressure, dust collectors, enclosures, etc. These shall be provided at no additional cost to the Contract. For field operations, install a full (total) enclosure surrounding all washing, coating and surface preparation activities. Refer to SSPC Guide 6.
- .2 The plans and drawing for the enclosure, scaffolds and platforms shall be submitted for review as detailed in Clause 1.4. Construction shall not begin until all these documents have been reviewed. Drawings are to include, but not be limited to, the following detailed information:
 - .1 Method and schedule of construction
 - .2 Actual loads to be imposed on the structure.
 - .3 Details of proposed attachments to the structure.
 - .4 Size and shape of all platform components.
 - .5 Scaffold erection and dismantling diagrams.
 - .6 Material specifications and sources.
 - .7 Arrangement of access platforms, ladders and guardrail.
- .3 At the conclusion of sandblasting and coating operations, the protective enclosure shall be dismantled and removed from the site.

3.7 COATINGS APPLICATION

- .1 All coatings shall be applied in accordance with the manufacturer's written instructions. Minimum and maximum dry film thickness shall conform to the requirements of NEPCOAT Qualified Products List A for Protective Coatings for New and 100% Bare Existing Steel for Bridges and as detailed in Clause 2.1 of this specification.
- .2 All measurements concerning DFT shall be measured by calibrating the Dry Film Gauge to read zero at the "top of the blasted profile". Measuring methods and equipment shall conform to SSPC-PA2.
- .3 For coating system, all edges, corners, crevices, rivets, bolts, welds and sharp edges shall be stripe coated with the aluminum polyamide epoxy mastic prior to the steel receiving the final coat in accordance with the coating manufacturer's recommendations. Such striping shall be done with brushes, daubers, or mitts and extend a minimum of 2.5 cm from the edge being coated. Brushes and daubers shall be provided and used to work coatings into cracks, crevices and locations which cannot be adequately coated by spray application.

3.8 EXTENDED WARRANTY

- .1 The Contractor shall warrant the coating system for a period of 60 months from the date of final completion of the contract. The warranty shall cover all defects in materials and/or workmanship in the coating system.
- .2 During the warranty period, the Departmental Representative will inspect the coating system, and will advise the Contractor and Manufacturer, in writing, of any repairs that are required. Intermediate inspections may be made and warranty repairs claimed and repaired by the Contractor and Manufacturer each year of the 60 months warranty period.
- .3 Failure of the protective coating system may include but not be limited to:
 - .1 Any debonding or failure of adhesion of the coating either to the structural steel or other coatings.
 - .2 The appearance of any rust stains on the coated structure due to loss of coating or leaking from joints between structural members.
 - .3 Failure of the coating to resist chipping and abrasion from normal site conditions.
 - .4 Any loss of normal gloss or rapid colour change.
- .4 Warranty repair will be completed within 45 days of notification, or if this would place repair in unsuitable weather conditions, by June 15 of the following year.
- .5 Repairs under warranty shall include all costs to supply material, labour and equipment necessary to restore the coating system to acceptable condition. Payment for warranty repairs will not be made separately, but will be considered included in the unit bid price for the fabricated steel trapezoidal box girders (Reference Section 05 12 33, Structural Steel for Bridges).

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 61 00 – Common Product Requirements
- .2 Section 32 11 16.01 – Granular Sub-Base
- .3 Section 32 11 23 – Aggregate Base Courses
- .4 Section 31 37 20 – Clear Stone

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles or Flat and Elongated Particles in Coarse Aggregate.
- .2 Newfoundland and Labrador Quarry Materials Act
 - .1 Consolidated Newfoundland and Labrador Regulation 804 – Quarry Materials Regulations (Revised 1996)

1.3 SOURCE APPROVAL

- .1 Provide copy of permit(s) for operation of pit/quarry.
- .2 Production of rock material for this project may be extracted from the Cod Knotts Quarry located in Gros Morne National Park provided all material meets the project specifications. All work in the quarry will be in accordance with the Cod Knotts Quarry – Rock Extraction Plan.
- .3 Inform Departmental Representative of proposed source of aggregates, provide current testing reports (dated within the last year) for physical properties of the proposed source of aggregates prepared by certified third party inspection agency for inspection and testing and provide access for sampling.
- .4 If, in opinion of Departmental Representative, aggregate from the proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that aggregate from source in question can be processed to meet specified requirements.
- .5 Should a change of aggregate source be proposed during work, advise Departmental Representative 1 week in advance of proposed change to allow sampling and testing.
- .6 Acceptance of an aggregate at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

1.4 SAMPLING

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Allow continual sampling by Departmental Representative during production.

- .3 Provide Departmental Representative with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
- .5 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Departmental Representative.
- .6 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .7 Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.

Part 2 Products

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable aggregate free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in a deleterious manner for the use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed three times least dimension.
- .3 Fine aggregate satisfying requirements of applicable section to be one, or a blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or a blend of the following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Light weight aggregate, including slag and expanded shale.

Part 3 Execution

3.1 DEVELOPMENT OF AGGREGATE SOURCE

- .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.
- .2 Where clearing is required, leave a screen of trees between cleared area and roadways in accordance with permit(s) and all land-use or zoning regulations which may apply.

- .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
- .4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
- .5 Trim off and dress slopes of waste material piles and leave site in neat condition.

3.2 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping of areas to be processed.
- .2 Avoid mixing topsoil with subsoil.
- .3 Stockpile in conformity with permit(s) and all land-use or zoning regulations which may apply. Stockpile height not to exceed 2 m.

3.3 PROCESSING

- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
- .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.
- .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
- .4 When operating in stratified deposits use excavation equipment and methods that will product uniform, homogeneous aggregate.

3.4 HANDLING

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

3.5 STOCKPILING

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Maximum 1.5 m for coarse aggregates and base coarse aggregate.

- .2 Maximum 1.5 m for fine aggregate and sub-base aggregate.
- .3 Maximum 1.5 m for other aggregate.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.6 SOURCE ABANDONMENT

- .1 For temporary or permanent abandonment of aggregate source, rehabilitate source to condition meeting conformity with permit(s) and all land-use or zoning regulations which may apply.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 17 – Pile Tests
- .3 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

- .1 All reference standards in this section shall be current issue or latest revision at the first date of project tender advertisement.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A252-98 (2002), Standard Specification for Welded and Seamless Steel Pipe Piles.
 - .2 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
 - .3 ASTM A325M-05, Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength Metric.
 - .4 ASTM A490M-04a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
 - .2 CAN/CSA-S16-14, Design of Steel Structures.
 - .3 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) (metric version).
 - .6 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.
 - .2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.
- .5 The Master Painters Institute (MPI)/Architectural Painting Specification Manual, (ASM-February 2004).
 - .1 MPI #19, Inorganic Zinc Rich Primer.
- .6 The Society of Protective Coatings (SSPC)
 - .1 SSPC-SP 5/NACE No.1-2000, White Metal Blast Cleaning Joint Surface Preparation Standard.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements: design templates to safely withstand following loads:
 - .1 Gravity loads to which template are subjected.
 - .2 Lateral loads to firmly hold pile in position when driving.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
 - .1 Include product characteristics, performance criteria, and limitations.
- .3 Submit shop drawings and indicate following items:
 - .1 Material.
 - .2 Anchorage, field control and alignment methods.
 - .3 Design parameters.
 - .4 Tolerance for driving pile.
 - .5 Removable method.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21- Type 350W.
- .2 Welding materials: to CSA W48 and CSA W59.
- .3 Bolts, nuts and washers: to ASTM A325.

2.2 FABRICATION

- .1 Fabricate structural steel for templates: to CAN/CSA-S16.
- .2 Welding: to CSA W59.
- .3 Use welding companies qualified under CSA W47.1.

Part 3 Execution

- .1 The design of pile templates is the responsibility of the Contractor. All pile template designs shall be stamped by a Professional Engineer Licensed to Practice in the Province of Newfoundland and Labrador, Canada.

3.2 POSITIONING

- .1 Position and hold template in location to receive piles.
 - .1 Ensure pile positions are within tolerances specified.
- .2 Secure templates to piles in accordance with shop drawings

3.3 REMOVAL OF TEMPLATES

- .1 Avoid damage to piling when removing templates.
- .2 When instructed by Departmental Representative, remove templates from Project site.

3.4 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 PROTECTION

- .1 Protect templates from damage.
- .2 Repair damage to templates, formwork or concrete arising from operations as reviewed by Departmental Representative at no extra cost.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 16 – Pile Driving Templates
- .3 Section 31 61 13 – Pile Foundations – General Requirements
- .4 Section 31 62 16.16 – Steel H Piles

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D1143-81 (1994) e1, Standard Test Method for Piles Under Static Axial Compressive Load.
 - .2 ASTM D4945-00, Standard Test Method for High-Strain Dynamic Testing of Piles.
- .2 AASHTO T298-99, Standard Method of Test for High-Strain Dynamic Testing of Piles.
- .3 Geotechnical Investigation, Rocky Barachois Bridge Replacement, Gros Morne National Park, File No: 163545, dated August 31, 2017, prepared by Harbourside Geotechnical Consultants.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Quality assurance submittals:
 - .1 Test reports: submit 3 copies of reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties. Report shall be in accordance with ASTM D4945-00.

Part 2 Products

Not Used.

Part 3 Execution

3.1 GENERAL

- .1 Contractor to notify Departmental Representative of pile driving operations at least seven (7) days in advance of work.
- .2 If a pile is suspect of meeting refusal on a boulder and within the native soils, Pile Driving Analyser (PDA) testing should be conducted to confirm capacity.
- .3 Supply and erect equipment and temporary structures necessary for making tests.

- .4 Departmental Representative to select piles for testing during performance of work.
- .5 Test to be performed in presence of Departmental Representative.
- .6 Provide shelter, enclosures and lighting for observation, testing and recording of data.
- .7 If PDA testing indicates that the design capacity is not obtained, the obstruction shall be removed by drilling, followed by removal of the obstruction and re-driving the pile.
- .8 PDA tests shall be performed on at least two (2) 406 mm diameter x 12.7 mm thick pipe piles per abutment to ensure pile capacities noted on the Drawings are met.
- .9 PDA testing shall be completed at the end of initial driving of piles installed and on the same piles during pile restrikes. A waiting period of at least 24 hours should be allowed before pile restrikes, to assess potential softening and soil setup effects.

3.2 TESTING

- .1 Do PDA testing in accordance with AASHTO T298.
- .2 Provide testing reports within two weeks of completing site testing. Report to bear signature and stamp of qualified professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada. The testing company shall provide (by e-mail) within 24 hours of site testing, confirmation that the design pile capacities have been achieved.

3.3 TEST EVALUATION

- .1 Qualified geotechnical engineer to interpret results for predicting pile performance and capacity.
- .2 Carry out additional load tests as directed by Departmental Representative if pile fails to sustain test load.
- .3 Test validity determined by Engineer.

3.4 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 43 - Environmental Procedures
- .3 Section 01 74 21 – Construction / Demolition Waste Management and Disposal

1.2 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of all stumps, roots, embedded logs, humus, root mat and topsoil from areas of excavations and embankments to not less than specified depth below existing ground surface.
- .6 Organic stripping consists of existing soil and organic material that has been grubbed from the site during grading operations. The intent for this project is to reuse the organic stripping as material for final landscaping treatments.

1.3 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, utility lines, water courses, root systems of trees and existing site fixtures which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

Part 2 Products

Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Contractor's sediment and erosion control.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify utility in ample time to minimize interruption of service. The Departmental Representative is to be provided copies on all correspondence.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

3.3 CLEARING

- .1 Clear all trees and underbrush by saw cutting. Mechanical brushers are not permitted.
- .2 Clearing is not permitted during nesting season which is anticipated to be between May 30 and July 15. Approval from the Departmental Representative must be given prior to commencement of clearing operation.
- .3 Clear areas as indicated and approved by the Departmental Representative. Generally, the areas to be cleared shall extend to a width of 3 m outside of excavation and embankment slope lines.
- .4 Clearing includes felling and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, rubbish and brush occurring within cleared areas.
- .5 Clear as indicated and as directed by Departmental Representative, by cutting at height of not more than 100 mm above ground.
- .6 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.

- .7 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.4 GRUBBING

- .1 Grub areas as indicated or as directed by the Departmental Representative. Generally, the areas to be grubbed shall extend to a width of 1.5 m outside of excavation and embankment slope lines.
- .2 Remove and dispose of all rootmat, stumps, embedded logs, humus, root mat and topsoil from areas of excavations and embankments to not less than 300 mm below existing ground surface.
- .3 Fill depressions made by grubbing with suitable material and to make new surface conform to existing adjacent surface of ground.

3.5 REMOVAL AND DISPOSAL

- .1 All cleared trees and timber shall become the property of the Contractor and are to be disposed of outside of Park boundaries.
- .2 All cut-off branches, underbrush, non-merchantable timber, etc. must be removed and disposed of outside of Park boundaries. Contractor shall not be permitted to drag and dispose of trees within adjacent woodland.
- .3 Stockpile grubbed material on site as indicated by Departmental Representative for reuse in final surface treatment.
- .4 Protect stockpiled grubbed material with erosion and sedimentation controls.

3.6 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 11 00 – Clearing and Grubbing
- .2 Section 32 15 60 – Roadway Dust Control

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 EXISTING CONDITIONS

- .1 Obtain clearance report from utilities regarding all underground services in the area.

Part 2 Execution

2.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate are acceptable for rough grading.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Examine existing conditions for any public or private service lines and report such to the Departmental Representative prior to starting work
 - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

2.2 WATER DISTRIBUTORS

- .1 Apply water with equipment capable of uniform distribution.

2.3 ROUGH GRADING

- .1 Rough grading shall consist of the excavation of the existing roadbed to a maximum depth of 500 mm for the purpose of reshaping to re-contour the area of the existing roadbed and surrounding area.
- .2 Excavated material shall be reshaped to the lines and grades as shown on the plans or as directed by the Departmental Representative.
- .3 Material shall be shaped and trimmed to eliminate ponding water with uniform surface and no soft spots.
- .4 Compact filled and disturbed areas to eliminate soft spots and eliminate erosion of material.

2.4 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.
- .2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties and watercourses.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 43 – Environmental Procedures
- .3 Section 01 55 26 – Traffic Regulation
- .4 Section 31 05 16 –Aggregate Materials
- .5 Section 32 11 23 – Aggregate Base Courses

1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 0.3 m³. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation. Common excavation shall include removal of existing pipe with no reduction in material for the void

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Traffic Control Plan for any lane reductions for review and approval by the Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

1.5 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site, if applicable.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

Part 2 Products

2.1 MATERIALS

- .1 Backfill material around structures shall be in accordance with Section 32 11 23 - Aggregate Base Courses.

Part 3 Execution

3.1 SITE PREPARATION

- .1 Cut pavement, if applicable, neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 STOCKPILING

- .1 Stockpile granular materials in manner to prevent segregation and for ready access in completing backfilling operation.
- .2 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.3 DEWATERING

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative review and approval details of proposed dewatering methods.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.4 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations and dimensions as indicated or as directed by Departmental Representative.
- .3 For trench excavation, one lane of travel must remain open at all times during the day and reinstate two lanes of traffic prior to completion of day's work.
- .4 Keep excavated and stockpiled materials safe distance away from edge of trench.
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Dispose of surplus and unsuitable excavated material off site.
- .7 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .8 Notify Departmental Representative when bottom of excavation is reached.
- .9 Obtain Departmental Representative approval of completed excavation.
- .10 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

3.5 BACKFILLING AND COMPACTION

- .1 Backfill around and over culverts as indicated or as directed by Departmental Representative.
- .2 Place granular backfill material, approved in writing by Departmental Representative, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

- .3 Compact each layer to 95% corrected maximum dry density taking special care to obtain required density under haunches.
 - .1 The top 300 mm below subgrade elevation shall be compacted to a minimum 98% of the corrected maximum dry density.
 - .2 Backfill above subgrade elevation shall be compacted to a minimum 100% of the corrected maximum dry density.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.
- .5 Place backfill in unfrozen condition.

3.6 RESTORATION

- .1 Reinstatement of pavements disturbed by excavation to thickness, structure and elevation which existed before excavation as directed by the Departmental Representative.
 - .1 In areas for which there will be a delay in reinstating the pavement, upon approval of the Departmental Representative regarding the delay, a smooth riding granular surface is to be continually maintained free of depressions, pot holes and dust.
- .2 Upon completion of Work, remove waste materials and debris and correct defects as directed by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29.06 – Health and Safety
- .3 Section 01 35 43 – Environmental Procedures
- .4 Section 02 41 16 – Structure Demolition
- .5 Section 31 05 16 –Aggregate Materials
- .6 Section 31 24 14 – Fill against Structure
- .7 Section 31 32 19.01 – Geotextiles.
- .8 Section 31 37 00 – Armour Rip Rap

1.2 SUMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of work.

Part 2 Products

Not Used

Part 3 Execution

3.1 Examination

- .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovering.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Install temporary barrier to separate and protect work zone from highway traffic.

- .3 Two lanes of undivided traffic shall be maintained on the existing bridge and approaches throughout construction / until traffic is diverted onto the new structure and realigned highway.

3.3 TEMPORARY DAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 – Health and Safety and Health and Safety Act for the Province of Newfoundland Labrador, Canada.
- .2 Construct temporary Works to depths, heights and locations as required.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while work is in progress.
- .2 Protect open excavations against flooding and damage due to surface run-off.
- .3 Dispose of water by pumping into vegetated areas in approved collection runoff areas and in manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
 - .2 Do not allow sediment laden water to reach adjacent watercourses.

3.5 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated on the drawings or as directed by Departmental Representative.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Keep excavated and stockpiled materials safe distance away from edge of trench.
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Dispose of surplus and unsuitable excavated material off site or in approved location on site as directed by the Departmental Representative.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undistributed soil, level, free from loose, soft or organic matter.
- .9 Notify Departmental Representative when bottom of excavation is reached.
- .10 Obtain Departmental Representative approval of completed excavation.
- .11 Remove unsuitable material from excavation bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation as follows:
 - .1 Fill with Fill Against Structure gravel compacted to not less than 98% of corrected Standard Proctor maximum dry density.

- .13 Install geotextiles in accordance with Section 31 32 19.02 - Geotextiles.
- .14 Protect environment from erosion and sediment, transport as per requirements of Environment Protection Plan.
- .15 The use of explosive or other means, which in the opinion of the Departmental Representative might disturb the existing structure, etc. shall not be permitted.
- .16 Boulders removed shall be satisfactorily utilized or disposed of as directed by the Departmental Representative.
- .17 After removal of forms and the required concrete strength has been achieved as noted on the Contract Drawings, the excavations around the structure shall be backfilled up to the level shown on the Contract Drawings, utilizing the backfill materials noted in the Contract Documents. Materials obtained from the foundation excavation shall not be used as backfill unless written approval to do so is provided by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 11 00 – Clearing and Grubbing
- .2 Section 31 23 33.02 - Foundation Excavation Bridge
- .3 Section 32 15 60 – Roadway Dust Control

1.2 REFERENCES

- .1 Definitions:
 - .1 Rock Excavation: excavation of:
 - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
 - .2 Boulder or rock fragments measuring in volume 1cubic metre or more.
 - .2 Common Excavation: excavation of materials that are not Rock Excavation.
 - .3 Unclassified Excavation: excavation of materials regardless of type.
 - .4 Free Haul: distance that excavated material is hauled without compensation.
 - .5 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved. Over Haul does not apply to this Contract.
 - .6 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
 - .7 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
 - .8 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
 - .9 Organic stripping consists of existing soil and organic material that has been grubbed from the site during grading operations. The intent for this project is to reuse the organic stripping as material for final landscaping treatments.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements:

- .1 Adhere to regulations of authority having jurisdiction when blasting is required

Part 2 Products

2.1 MATERIALS

- .1 Embankment materials require approval by Departmental Representative.
- .2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.
- .3 Borrow material:
 - .1 Obtain from sources such as quarry, or borrow pit as approved by Departmental Representative.
 - .1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.
 - .2 Rock Embankment material to consist of fragmented rock produced by drilling and blasting operations, and boulders which cannot be placed in layers as specified for Earth Embankments.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 COMPACTION EQUIPMENT

- .1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of achieving required density of project materials.
 - .1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
 - .2 Replace or supplement equipment that does not achieve specified densities.

3.3 WATER DISTRIBUTORS

- .1 Apply water with equipment capable of uniform distribution.

3.4 STRIPPING

- .1 Commence topsoil stripping of areas as directed by Departmental Representative after brush has been removed from these areas.
- .2 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height: not to exceed 2 m.
- .4 Remove clearing and grubbing debris from stripping.
- .5 Spread organic stripping, on completion of excavation and embankment construction, on slopes and trim or remove from site if quantity exceeds ability to grade on site.

3.5 EXCAVATING

- .1 General:
 - .1 Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.
 - .2 Sub-excavate rock 500 mm below subgrade in cut sections unless otherwise directed by Departmental Representative.
 - .1 Replace with approved embankment material or borrow material and compact to specified embankment density.
 - .3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.
- .2 Drainage:
 - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
 - .2 Construct ditches as work progresses to provide drainage.
 - .3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
- .3 Rock excavation:
 - .1 Notify Departmental Representative, when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide a minimum of 12 hours notification.
 - .2 Blasting of rock is not permitted unless approved by the Departmental Representative.
 - .3 Reduce overbreak and increase stability of rock faces by using smooth blasting techniques.
 - .4 Use smooth blast and excavate short sections in rock cuts to determine optimum spacing of holes when requested by Departmental Representative.
 - .5 Stem holes as necessary to contain blast.
 - .6 Do not use prilled type ammonium nitrate and fuel oil (ANFO) explosives within 4 m of final cut line.
 - .7 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.

- .8 Control blasting to minimize flying particles.
- .9 No undrained pockets shall be left in the rock surface.
- .4 Borrow Excavation:
 - .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
 - .2 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

3.6 EMBANKMENTS

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
 - .1 Method used to be pre-approved in writing by Departmental Representative.
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material that is frozen nor place material on frozen surfaces except in areas authorized by Departmental Representative.
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
 - .1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .6 Where material consists of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 450 mm.
 - .2 Distribute rock material to fill voids with smaller fragments such that the interstices around rock are filled with fine material to form compact mass.
 - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
 - .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 500 mm of subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

3.7 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Deposit, spread, and blade smooth in successive uniform layers embankment material in layers 200 mm maximum thickness to the full width of the cross section.
 - .1 Ensure required compaction for each layer before placing any material for next layer.
- .3 Compact top 300 mm of subgrade in areas of excavation.

- .4 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.
- .5 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results.
- .6 Compact each layer to minimum 95% of the Standard Proctor maximum dry density or the acceptable Control Strip Density except top 300 mm of subgrade.
 - .1 Compact top 300 mm in 150 mm layers to a minimum 98% of the Standard Proctor maximum dry density or the acceptable Control Strip Density.
- .7 Add water or dry as required to bring water content of materials to level required to achieve specified compaction.
- .8 For material containing less than 30% oversize (retained on 20 mm sieve) the test method shall be Standard Proctor Test – ASTM D698.
- .9 For maximum dry density for material containing more than 30% oversized shall be determined using method prescribed herein as Control Strip.
- .10 Control Strip Method:
 - .1 A Control Strip is a lift of material constructed on a 30 m section, minimum 3 m wide, of prepared surface selected by the Departmental Representative.
 - .2 A maximum dry density “Control Density” shall be established on a lift of material using the equipment and method of compaction as prescribed herein for construction of a Control Strip.
 - .3 A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. Each Control Strip shall remain in place and become a portion of the completed base course.
 - .4 To determine the Control Density, a minimum of six water content and density tests shall be taken at random locations by the Departmental Representative, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.
 - .5 The maximum compacted thickness of each layer shall not exceed 200 mm except when it can be demonstrated, in construction of the Control Strip, that adequate compaction of thicker lifts is possible.
 - .6 No additional lift shall be placed until the control density is determined and the compacted lift is approved by the Departmental Representative.
 - .7 The Control Strip water content shall be adjusted to produce necessary compaction as directed by the Departmental Representative. If the Control Strip compaction is being adversely affected by the water content of the soil, being either excessive or deficient, the Control Strip construction shall not continue until the water content is reduced or increased, to produce necessary compaction.
 - .8 The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted.
- .11 Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or

centrifugal force of 8000 kg, operated in a vibratory mode, at a speed not exceeding 8 km/h.

- .12 Control Density Determination.
 - .1 A lift of material shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements of the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.
 - .2 A pass shall be one complete coverage of the Control Strip layer with the compaction equipment.
 - .3 Testing of the Control Strip shall be discontinued when the average dry density between each series of passes increases by less than 10 kg/m^3 , continually decreases, or remains constant.
- .13 The maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

3.8 FINISHING

- .1 Shape entire roadbed to within 25 mm of design.
- .2 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable. Scale slope by removing loose fragments, for cut slopes in bedrock steeper than 1:1.
- .3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .4 Hand finish slopes that cannot be finished satisfactorily by machine.
- .5 Round top of backslope 1.5 m both sides of top of slope.
- .6 Run tractor tracks over slopes exceeding 3 m in height to leave tracks parallel to centreline of highway.
- .7 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

3.10 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.
- .2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 16 – Aggregate Materials
- .2 Section 31 32 19.01 – Geotextile
- .3 Section 32 11 23 – Aggregate Base Courses

1.2 REFERENCES

- .1 ASTM C117, Test Method for Material Finer Than 75 m Sieve in Mineral Aggregate by Washing.
- .2 ASTM C131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

Part 2 Products

2.1 MATERIALS

- .1 Crushed and screened gravel or rock approved by the Departmental Representative prior to placement.
- .2 Material shall be tested in accordance with ASTM C117 and ASTM C136 and shall conform to the following gradation:

<u>Sieve Size mm</u>	<u>Percent Passing</u>
112	100
40	60 – 85
5	25 – 50
0.315	5 – 15
0.080	2 – 7

- .3 Fill Against Structure shall conform to the physical properties requirements listed in the following:

<u>Property</u>	<u>Test Method</u>	<u>FAS</u>
LA Abrasion (Grading A)	ASTM C131	45
Plasticity Index (Sand Portion)	ASTM D4318	< 6

Part 3 Execution

3.1 PLACING

- .1 The embankment underlying the Fill Against Structure shall be compacted as indicated on the drawings or as directed by the Departmental Representative.
- .2 Prior to placing structural fill, inspect subgrade to assure stability. Do not proceed with filling operations until these areas are approved by the Departmental Representative.
- .3 Fill material shall be placed in layers not exceeding 300 mm in thickness and each layer compacted as specified herein by means of a vibratory compactor.
- .4 Compaction of Fill Against Structure shall be compacted as in accordance with Section 32 11 23 Aggregate Base Coarses.
- .5 Extents of Fill Against Structure shall be as indicated on the Drawings or as determined by the Departmental Representative.
- .6 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .7 Do not use Fill Against Structure material which is frozen or contains ice, snow or debris.

3.2 SITE TOLERANCES

- .1 The extent of Fill Against Structure shall be as indicated on the plans or as determined by the Departmental Representative.

3.3 PROTECTION

- .1 Upon completion of Work, remove waste materials and debris and correct defects as directed by Departmental Representative.
- .2 Maintain finished slopes and lines until subsequent material is placed covering the Fill Against Structure.
- .3 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedure
- .2 Section 31 24 14 – Fill Against Structure
- .3 Section 31 37 00 – Armour Rip-Rap
- .4 Section 31 37 20 – Clear Stone

1.2 REFERENCES

- .1 All current standards at the time of initial advertisement of tender apply
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permeability.
 - .2 ASTM D4595, Standard Test Method for Tensile Properties of Geotextile by Wide-Width Strip Method.
 - .3 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2 No. 11.2-M89, Textile Test Methods – Bursting Strength – Ball Burst Test (Extension of September 1989)
 - .2 CAN/CGSB-142.1-2003, Methods of Testing Geotextiles and Complete Geomembranes – Complete Set.
 - .1 No. 2, Methods of Testing Geotextiles and Geomembranes – Mass per Unit Area.
 - .2 No. 3, Methods of Testing Geotextiles and Geomembranes – 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 Geotextiles and Geomembranes – Filtration Opening Size.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports:

- .1 Submit copies of mill test data and certificate at least 4 weeks prior to start of Work.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

Part 2 Products

2.1 MATERIAL

- .1 Geotextile: woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 3.81 m minimum.
 - .2 Composed of: UV protected material.
- .2 Physical properties:
 - .1 Grab tensile strength and elongation: to CAN/CGSB-148.1, No. 7.3.
 - .1 Breaking force: minimum 1100 N, wet condition.
 - .2 Elongation at break: maximum 15%.
 - .2 Mullen burst strength: to CAN/CGSB-4.2, No. 11.2, minimum 3.0 MPa, wet condition.
 - .3 Bursting strength: use values specified in CAN/CGSB-148.1, No. 6.1, wet condition.
- .3 Hydraulic properties:
 - .1 Apparent opening size (AOS): to ASTM D4751, 50 µm (minimum) 150 µm (maximum).
 - .2 Hydraulic Conductivity, 0.01 cm/sec.
 - .3 Permeability: to CAN/CGSB-4.2 No. 11.1-9.

Part 3 Execution

3.1 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with security pins.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases. Stop geotextile 100 mm below finished surface.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.

- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 hours of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Design Departmental Representative.

3.2 CLEANING

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner. Recycle material if at all possible.

3.3 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

3.4 QUALITY CONTROL

- .1 The Contractor shall supply documentation from the manufacturer that the supplied material meets all specified as follows:

<u>Test Type</u>	<u>Standard</u>
Opening	ASTM D4751
Bursting Strength	CAN/CGSB-4.2, No. 11.2
Mass/Unit Area	CAN/CGSB-148.1, No. 2
Thickness	CAN/CGSB-148.1, No. 3
Burst	CAN/CGSB-148.1, No. 6.1
Tensile	CAN/CGSB-148.1, No. 7.3
Filtration Opening	CAN/CGSB-148.1, No. 10
Grab Tensile Strength and Elongation	CAN/CGSB-148.1, ASTM D4595
Permeability and Water Flow Rate	ASTM D4491

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 02 41 16 – Structure Demolition
- .2 Section 31 24 14 - Fill Against Structure
- .3 Section 31 32 19.01 – Geotextiles

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C127-07, Test Method for Material Finer Than 75 µm Sieve in Mineral Aggregate by Washing.
 - .2 ASTM C131-06, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 ARMOUR STONE

- .1 Armour stone shall be hard, durable, field or quarry stone, free from splits, seams or defects likely to impair its soundness during handling or by the actions of water and ice. Shale, slate or rocks with thin foliations shall not be acceptable. The greatest dimension of each stone shall not exceed two times the least dimension. The minimum density of the stone shall be 2 650 kg/m³. Physical properties shall be as defined as:

Property	Test Method	Armour Rock
Absorption % maximum	ASTM C 127	1.5
Los Angeles Abrasion, % maximum	ASTM C 131	35

Sizes of Armour Rip Rap shall be defined as:

Approximate Maximum Dimension, mm	Percent Smaller Than
1 050	100
650	0 – 50
300	0 - 15

2.2 GEOTEXTILE FILTER

- .1 Geotextile: in accordance with Section 31 32 19.01 - Geotextile.

Part 3 Execution

3.1 PLACING

- .1 Where armour rip rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2 Fine grade area to be armoured to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01 - Geotextile and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .4 Place armour rip rap to thickness and details as indicated.
- .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 The Armour Rip Rap shall be placed to the lines and grades shown on the drawings or as directed by the Departmental Representative. Placement shall be by machine in order to avoid waste and to ensure that the stone is in a stable position.
- .7 Final grading of slopes surrounding new abutments shall be completed within the allowable time for in water work as described in the specifications.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 16 – Aggregate Materials

1.2 REFERENCES

- .1 All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C127-15, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 4318 Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - .5 MTO LS-618, Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

Part 2 Products

2.1 MATERIALS

- .1 Clear stone material: shall consist of hard, durable stone particles and free from elongated or objectionable pieces. Material shall be tested in accordance with ASTM C117 and ASTM C136 and shall conform to the following gradation table:

<u>Sieve Size, mm</u>	<u>Percent Passing</u>				
	C1	C2	C3	C4	C5
250	100				
200		100	100		
150	20-35	90-100	90-100		
112		0-10	20-35	100	
80			0-20	90-100	
56	0-10				
28				0-10	100
20			0-10		90-100
10					0-40
5					0-10

- .2 Material shall conform to the physical properties listed in the table below:

<u>Property</u>	<u>Test Method</u>	<u>Clear Stone</u>
Absorption % max.	ASTM C 127	1.75
Plasticity Index	ASTM D 4318	0
Micro-Deval % max.	DOT&PW TM-1	25

Part 3 Execution

3.1 CONSTRUCTION METHODS

- .1 Where clear stone is to be placed on slopes, abutment drainage pipe ends, culvert ends, gutter ends, ditches or elsewhere directed by the Departmental Representative, excavate or prepare surface as directed.
- .2 Place geotextile on prepared surface in accordance with Section 31 32 19.01 - Geotextile and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .3 Place clear stone to thickness and details as indicated or directed by Departmental Representative.
- .4 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass.
- .5 The clear stone shall be placed to the lines and grades shown on the drawings or as directed by the Departmental Representative. Placement and compaction shall be by machine in order to avoid waste and to ensure that the stone is in a stable position.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 16 – Pile Driving Templates
- .3 Section 31 09 17 – Pile Tests
- .4 Section 31 62 16.13 – Steel H Piles – Temporary Retaining Wall
- .5 Section 31 62 16.16 – Steel Pipe Piles

1.2 REFERENCES

- .1 Geotechnical Investigation, Rocky Barachois Bridge Replacement, Gros Morne National Park, File No: 163545, dated August 31, 2017, prepared by Harbourside Geotechnical Consultants.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Departmental Representative and await further instructions.
- .4 Submit pile installation plan to Departmental Representative for review, as specified. This list shall include, as a minimum:
 - .1 Description of overall construction sequence and the order in which piles will be installed.
 - .2 A list, description, and capacities of proposed equipment, including but not limited to cranes, drills and pile hammers.
 - .3 Details of drilling methods, including the bit/shoe and use of any drilling fluids.
- .5 Spliced piles: when authorized, submit design details of splice complete with signature and stamp of qualified professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada. All splices of piles shall be designed and constructed as full-strength splices. Acceptance criteria for welds shall be as per W59 Section 11, Statically Loaded Structures.
 - .1 Contractor is responsible for the testing of all full strength pile splices.
 - .2 Welds shall be visually inspected. All full penetration welds shall be 100% inspected by Radiographic or Ultrasonic methods.
- .6 Equipment:
 - .1 Submit prior to pile installation for review by Departmental Representative, list and details of equipment for use in installation of piles.
 - .2 Drilling methods: submit characteristics to evaluate performance.
 - .3 Impact hammers: submit manufacturer's written data as specified.

- .7 Quality assurance submittals:
 - .1 Test reports: submit 3 copies of certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Wave Equation Analysis to confirm driving criteria performed by a geotechnical engineering registered or licensed in Province of Newfoundland and Labrador, Canada.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's instructions.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles as directed by Departmental Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Recycle cut-off or damaged portions of piles.

1.6 EXISTING CONDITIONS

- .1 Harbourside Geotechnical Consultants Geotechnical Report No. 163545, Dated August 31, 2017 is provided with the Contract Documents for reference purposes. PCA assumes no responsibility for the contents of this report and the Contractor shall conduct their own investigations as required, but without impacting traffic, the existing bridge or the surrounding environment, to determine actual sub-surface conditions.
- .2 Cobbles and boulders were encountered throughout the boreholes drilled as part of the geotechnical investigation. Therefore, pile drilling operations should be planned anticipating that the piles may encounter cobbles and boulders throughout the overburden.
- .3 Notify Departmental Representative in writing if subsurface conditions at site differ substantially from those indicated and await further instructions from Departmental Representative.

1.7 SCHEDULING

- .1 Provide schedule of planned sequence of pile installation to Departmental Representative for review, not less than two weeks prior to commencement of pile installation.

Part 2 Products

2.1 MATERIALS

- .1 Material requirements for piles are specified in Section 31 62 16.16 – Steel Pipe Piles.

- .2 Supply or fabricate piles as indicated. Pile lengths should be detailed to minimize pile splices as much as practical.
- .3 The number and location of full strength pile splices shall be approved in writing by the Departmental Representative.
 - .1 Provide details of full strength splice for Departmental Representative review.
 - .2 Design details of full strength welded pile splice to bear dated signature stamp of professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

2.2 EQUIPMENT

- .1 Piles are to be drilled into place using equipment capable of drilling the piles to the required depth.
 - .1 Piles shall be drilled a minimum of 500 mm into bedrock as indicated on the project drawings.
- .2 An impact hammer shall be used to tap the piles after they have been drilled into place.
 - .1 The impact hammer shall provide sufficient energy to prove the factored geotechnical resistance using the Pile Driving Analyzer.
 - .2 Pile hammer shall be capable of providing a variable energy and have a minimum rated energy of 49 kJ.
 - .3 When required criteria cannot be achieved with the proposed hammer, use a larger hammer and take other measures as required.
 - .4 Provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.

Part 3 Execution

3.1 PREPARATION

- .1 Protection:
 - .1 Protect adjacent structures, services and work of other sections from hazards due to pile installation operations.
 - .2 Arrange sequencing of pile installation operations and methods to avoid damages to adjacent existing structures.
 - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
 - .4 Ensure that pile installation operations have no impact on the two lanes of traffic on the highway and existing bridge adjacent to the work site.
- .2 Ensure that ground conditions at the pile locations are adequate to support pile installation and load testing operation.
 - .1 Make provision for access and support of piling equipment during performance of Work.

- .3 Drive H piles for Temporary Retaining Wall as indicated in Section 31 62 16.13 to the depths specified on the Contract Drawings.
- .4 Install pipe piles only after temporary retaining wall is installed and excavation to the underside of abutment pile caps has been completed.

3.2 INSTALLATION

- .1 Advance pipe pile to bedrock by drilling to remove any obstacles. Once pile tip is a minimum of 500 mm into bedrock, drive each pile to refusal as indicated on the Contract Drawings. Report final pile tip elevations to Departmental Representative for review.
- .2 Compatibly sized outside cutting shoes, drill bits, or cutting teeth shall be used with pipe piles to advance the pile to bedrock using drilling methods to pass through or remove obstacles such as cobbles and boulders.
- .3 Design load capacity of pipe piles is as follows:
 - .1 Assumed design pile capacity at ultimate limit states = 1255 kN(C) for 406 outer diameter x 12.7 thick plumb abutment pipe piles.
- .4 Installation of each pile will be subject to review by Departmental Representative.
 - .1 Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration, tolerance or other criteria used to determine load capacity and pile final position / elevations.
 - .2 Departmental Representative to review final installation of all piles before demobilization of pile installation equipment from site.
- .5 Pile Driving
 - .1 After drilling pile into bedrock, drive each pile to practical refusal.
 - .2 Contractor to determine hammer requirements and initial pile set/refusal criteria by wave equation analysis.
 - .3 Do not overdrive to cause damage to piles in bedrock.
 - .4 Final refusal criteria for piles driven to rock to be approved by Departmental Representative.

3.3 APPLICATION

- .1 The excavation and drilling equipment shall have adequate capacity (including power, torque and down thrust) to advance the piles into bedrock to the depths required.
- .2 Use driving caps and cushions to protect piles during driving.
 - .1 Reinforce pile heads as required by Departmental Representative.
 - .2 Piles with damaged heads as determined by Departmental Representative will be rejected.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile.
- .5 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.

- .6 Cut off piles neatly and squarely at elevations as indicated to tolerance of plus or minus 5 mm.
 - .1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
- .7 Remove and recycle cut-off lengths from site upon completion of work.

3.4 INSTALLATION TOLERANCES

- .1 Piles to be installed within ± 75 mm of theoretical position.
- .2 Piles not to be more than 1% of length out of vertical alignment.

3.5 OBSTRUCTIONS

- .1 Pipe piles to be advanced to bedrock by drilling in order to remove obstructions as the pile advances.

3.6 REPAIR AND RESTORATION

- .1 Pull out rejected piles and replace with new piles.
- .2 Remove rejected pile and replace with new, and if necessary, longer pile.
- .3 Remove rejected pile and fill hole as directed by Departmental Representative.
- .4 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

3.7 FIELD QUALITY CONTROL

- .1 Testing agency appointed by Departmental Representative will use Pile Driving Analyzer and Wave Equation Analysis to confirm driving criteria. Included are: hammer size, suitability of driving cap and cushions, and penetration resistance relative to set for initial driving and re-striking.
 - .1 Departmental Representative to select piles for testing.
 - .2 Work to be performed by geotechnical engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .2 Prepare piles to be instrumented by drilling and tapping holes for installation of strain transducers and accelerometers, as directed by Departmental Representative.
- .3 Provide assistance, as required, in instrumentation process during initial set-up and during test.
- .4 Make allowance for probable interruption in driving for:
 - .1 Changing/modifying hammer, cap, cushions, or other equipment;
 - .2 Replacing/adjusting of transducers and accelerometers;
 - .3 Assessing of monitored results.
- .5 Replace/adjust hammer and modify cap, cushions, and other equipment, as directed by Departmental Representative.
- .6 Confirm that final set has been achieved, when instructed by re-striking instrumented piles as directed one (1) day after determination of penetration resistance for initial set.

- .7 Confirm load carrying capacity of two (2) instrumented piles per abutment, unless instructed otherwise by Departmental Representative by performing load test in accordance with Section 31 09 17 - Pile Tests.
- .8 Maintain accurate records of installation for each pile, including:
 - .1 Type and make of drilling equipment used, including any changes to the equipment used.
 - .2 Type and amount of drilling fluid used.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Dates of installation.
 - .5 Rates of advancement (min/300 mm).
 - .6 Method of excavation.
 - .7 Seepage/groundwater conditions.
 - .8 Sequence of pile installation in group.
 - .9 Final tip and cut-off elevations.
 - .10 Other pertinent information such as interruption of drilling or pile damage.
 - .11 All measurements, observations and calculations associated with pile driving analyzer and wave equation analysis.
 - .12 Provide Departmental Representative with three copies of records.

3.8 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 10 00 – Concrete Forming and Accessories
- .4 Section 03 20 00 – Concrete Reinforcing
- .5 Section 03 30 00 – Cast-in-Place Concrete
- .6 Section 31 23 33.02 – Excavation for Bridge
- .7 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A563-15 Standard Specification for Carbon and Alloy Steel Nuts
 - .2 ASTM A29/A29M-16 Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
 - .3 ASTM F436-11 Standard Specification for Hardened Steel Washers
 - .4 ASTM A325-09 Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.
 - .5 ASTM A722/A722M-15 Standard Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete
- .2 CSA International
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
 - .3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
 - .4 CAN/CSA S6-14 Canadian Highway Bridge Design Code (CHBDC).
 - .5 CAN/CSA O86-14 Engineered Design in Wood.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets for steel piles.
 - .2 Submit manufacturer's printed product literature, specifications and datasheets for timber, miscellaneous steel, and all other material required to complete work.
- .3 Preconstruction Submittals:

- .1 Submit construction equipment list for major equipment to be used in this section prior to start of work.
- .4 Any alternate retaining wall system shall be designed by a Professional Engineer Licensed to Practice in Newfoundland and Labrador, stamped drawings and calculations shall be provided for review at least eight (8) weeks prior to the start of construction. This review is for general conformance only and in no way limits the responsibility of the Contractor who shall remain fully responsible for the design of any alternate temporary retaining system. Approval for any alternate retaining system must be gained after a maximum of two rounds of submittals by the Contractor otherwise the Contractor shall construct the retaining wall as originally detailed in the Contract Documents. Approval of any alternate retaining wall system must be gained at least four (4) weeks prior to the start of construction. If approval is not granted in this time frame, the Contractor shall continue with construction of the design as originally detailed in the Contract Documents. The Contractor shall make no claims for delays associated with failure to gain approval of an alternate retaining system.**
- .5 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Shop drawing review by the Designer is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Designer approves the detailed design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of work.
 - .3 Each drawing submitted to bear signature and stamp of qualified Professional Engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.
 - .4 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, shims, threaded fasteners and welds. Indicate welds by CSA W59 welding symbols.
 - .5 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.
 - .6 Submit description of methods, temporary bracing, sequence of erection and type of equipment proposed for use in erecting steel H pile and timber lagging temporary retaining walls (reference Part 3 of this Section for further details / requirements for erection steel H pile temporary retaining walls).
 - .7 The Contractor shall schedule 2 weeks (10 business days) for the detailed single review of the temporary retaining wall shop drawings. This review time will start the following business day after the Contractor has submitted the shop drawings to the Departmental Representative. If additional reviews of shop drawings are required, then additional time beyond that scheduled for the initial review will be

required and the time required for subsequent shop drawing reviews shall not be constituted in any way by the Contractor as a delay.

- .6 Certificates:
 - .1 Submit 2 weeks prior to fabrication, 2 copies of steel producer and mill test reports in accordance with CSA G40.20/G40.21.
 - .2 Submit copy of certification for fusion welding in accordance with CSA W47.1.
 - .3 Submit 2 weeks prior to installation, all material data sheets for timber lagging.

1.4 QUALITY ASSURANCE

- .1 Inspection and testing of steel H piling material will be carried out by testing laboratory designated by Departmental Representative at any time during course of Work.
- .2 Inspection and testing of cast-in place concrete will be carried out by testing laboratory designated by Departmental Representative at any time during course of Work.
- .3 Materials inspected or tested by Departmental Representative which fail to meet contract requirements will be rejected and replaced at the Contractor's own expense.
- .4 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Contractor to pay costs for additional tests or inspections and corrections. Departmental Representative to approve corrected work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations.
 - .2 Store and protect all materials from damage.
 - .3 Replace defective or damaged materials with new.
- .4 Use slings for lifting piling. Make sure mass is evenly distributed and piling is not subjected to excessive bending stresses.
- .5 Store piling on level ground or provide supports so that piling is level when stored.
 - .1 Provide blocking at spacing not exceeding 5 m so that there is no excessive sagging in piling.
 - .2 Overhang at ends not to exceed 0.5 m.
 - .3 Block between lifts directly above blocking in lower lift.
- .6 If material is stock-piled on or near structure, ensure structure is not overloaded.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel for H-Piles, walers, bearing plates, waler splice plates, and miscellaneous steel: to CAN/CSA G40.21, Grade 350W.
- .2 Structural Hexagonal Nuts: to ASTM A563-07
- .3 Washers: to ASTM F436-11
- .4 Anchor Tie rods, sleeve nuts and turnbuckles:
 - .1 Tie rods: to ASTM A722, Grade 150 ksi.
 - .2 Hex Nuts: to ASTM A29
 - .3 Hardened Washers: to ASTM F436
 - .4 Sleeve nuts, and connector sleeves: to have load capacity in excess of capacity of tie rod.
 - .5 Preassemble, mark and test tie rod assemblies in shop. Align threaded connection to following tolerances at sleeve nut or connector sleeve: 1/80 of normal rod diameter, deviation of centreline, 1 in 160.
- .5 Backfill material: to Section 31 23 33.02 – Excavating for Bridge
- .6 Timber Lagging: Rough sawn timber to CAN/CSA O86-14 with as a minimum $f_b = 11$ MPa and $f_v = 1.2$ MPa
- .7 Concrete deadmen concrete: $f_c' = 35$ MPa at 28 days
- .8 Steel reinforcement for concrete deadmen to be deformed bars and conform to CSA-G30.18M and CSA A23.1/A23.2, Grade 400.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that existing soil conditions are acceptable for steel pile installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect existing soils in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2

3.2 INSTALLATION

- .1 Steel H-piles for the temporary retaining wall may be installed by vibratory, impact or drilling methods provided they are able to obtain the required pile embedment depths.
- .2 Piles are to be installed to the depths shown on the Contract Drawings.
- .3 Installation of each pile will be subject to review of Departmental Representative.

- .1 Departmental Representative will be sole judge of acceptability of each pile with respect to depth of penetration, tolerance or other criteria used to determine pile final position / elevations.
- .2 Departmental Representative to review final installation of all piles prior to removal of pile installation equipment from site.
- .4 Cut off piles neatly and squarely at elevations as indicated to tolerance of plus or minus 5 mm.
- .5 Remove and recycle cut-off lengths from site upon completion of work.
- .6 When installation is complete, face of H Pile flange at top of pile to be within 75 mm of location as indicated and deviation from vertical not to exceed 1 in 100.
- .7 Submit full details of method and sequence of installation of piling to Departmental Representative for approval prior to start of pile installation work. Details must include templates, bracing, driving shoes, setting and driving sequence and number of piles in panels for driving.
- .8 The existing steel guard rail adjacent to the temporary retaining wall shall remain in place throughout construction.
- .9 Do welding in accordance with CSA W59.
- .10 As excavation progresses install timber lagging. No more than 300 mm of excavation shall be completed in advance of lagging installation. Install walers, tiebacks, and concrete dead men prior to advancing the excavation beyond the Waler installation elevation noted on the Contract Drawings.
- .11 One lane of alternating traffic shall be maintained during the installation of the H-piles and the installation of the concrete dead man.
- .12 See Section 01 55 26 for closure and traffic control requirements. Construction to be continuous operation to minimize length of time traffic is reduced to single lane, alternating traffic. Submit traffic control plan and schedule of lane closures for Departmental Representative approval at least 5 days prior to construction.
- .13 Pile Driving (at Contractor's option):
 - .1 Leads:
 - .1 Construct pile driver leads to provide free movement of hammer.
 - .2 Hold leads in position at top and bottom, with guides, stiff braces, or other means reviewed by Departmental Representative to ensure support to pile while being driven.
 - .3 Length: provide sufficient length of leads to ensure that use of follower is unnecessary.
 - .4 Swing leads: Not permitted
 - .2 Followers:
 - .1 Provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth.
 - .2 Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

- .3 Compatibly sized H pile drive shoes shall be used to protect all piles during driving.
- .4 Use driving caps and cushions to protect piles.
 - .1 Reinforce pile heads as required by Departmental Representative.
 - .2 Piles with damaged heads as determined by Departmental Representative will be rejected.
- .5 Hold piles securely and accurately in position while driving.
- .6 Deliver hammer blows along axis of pile.

3.3 OBSTRUCTIONS

- .1 If obstructions (cobbles or boulders) or difficult driving conditions are encountered during installation, the Contractor shall contact the Departmental Representative and provide a plan for removal of the obstruction for review. Once approved by the Departmental Representative to proceed with the removal plan, remove obstruction or relocate pile as directed by the Departmental Representative.
- .2 The Contractor shall advise the Departmental Representative of any obstructions encountered when they occur. The Contractor shall be entitled to no claim of a delay as a result of encountering obstructions. A contract schedule extension may be considered to account for the additional time required to complete the work at the discretion of the Departmental Representative. No consideration will be given to additional costs associated with any hard driving conditions encountered. Harbourside Geotechnical Consultants Geotechnical Report No. 163545, Dated August 31, 2017 is provided with the Contract Documents for reference purposes. PCA assumes no responsibility for the contents of this report and the Contractor shall conduct their own investigations as required, but without impacting traffic, the existing bridge or the surrounding environment, to determine actual sub-surface conditions.

3.4 HOLES

- .1 Do not drill any holes in the piling without permission of Departmental Representative. Do not use flame cutting without permission of Departmental Representative.

3.5 CUTTING

- .1 When flame cutting tops of piles, use following procedure:
 - .1 When air temperature is above 0 degrees C, no pre-heat is necessary.
 - .2 When air temperature is below 0 degrees C, pre-heat until steel 25 mm on each side of line of cut has reached a temperature very warm to hand (approximately 35 degrees C).
 - .3 Use torch guiding device to ensure smooth round holes or straight edges.
 - .4 Make cut smooth and free from notches throughout thickness. If grinding is employed to remove notch or crack, finished radius to be minimum 5 mm.

3.6 SPLICING

- .1 Use full length piles unless splicing is approved on site by Departmental Representative.

3.7 TIE ROD ANCHORAGE SYSTEM

- .1 Install tie rods, walers and deadmen as outlined in installation procedure on Contract Drawings.
- .2 Do not remove material from in front of shoring walls below elevations noted until piles have been completely driven, adjusted and secured in final position by anchorage system.
- .3 Drilling through overburden for tie rod installation must be carried out from the excavation side of the shoring walls and drilling towards deadmen locations. This is to ensure proper location of tie rods on walers. Tie rods may be installed by drilling/advancing below the existing roadbed or may be installed in partial length segments during alternating single lane closures.
- .4 One tie rod requires drilling through the existing abutment wing walls. The hole shall be core drilled and the hole diameter shall not exceed 75 mm.
- .5 Support tie rods at intervals along their length as indicated on drawings or as per manufacturer's recommendations.
- .6 Fit and adjust tie rod systems so that connections at waling and anchor end of tie rods are tight before backfilling deadmen.
- .7 Ensure waler, tie rods and deadmen are fully installed before proceeding with further excavation.

3.8 BACKFILLING

- .1 Backfill in accordance with Section 31 23 33.02 - Excavating for Bridge and as indicated.
- .2 Protect piling, tie rods and anchorage systems from damage or displacement during backfilling operations.

3.9 ROAD MAINTENANCE

- .1 The Contractor is responsible to maintain Highway 430 throughout construction. Any cracking or damage to the road surface as a result of movement of the temporary retaining wall shall be repaired immediately.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 30 00 – Cast in Place Concrete
- .4 Section 31 09 16 – Pile Driving Templates
- .5 Section 31 09 17 – Pile Tests
- .6 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

- .1 American Petroleum Institute (API)
 - .1 API SPEC 5L-04, Specification for Line Pipe, 45th Edition
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A252-10, Standard Specification for Welded and Seamless Steel Pipe Piles.
 - .2 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.
 - .3 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .4 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .5 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).
 - .6 CAN/CSA S16-14, Design of Steel Structures.
 - .7 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).
- .4 Geotechnical Investigation, Rocky Barachois Bridge Replacement, Gros Morne National Park, File No: 163545, dated August 31, 2017, prepared by Harbourside Geotechnical Consultants.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Submit shop drawings and indicate: pile shoes, splice detail, pile cap details, tip reinforcement.

- .1 Each drawing stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .2 All splices of piles shall be designed and constructed as full-strength splices.
- .3 Shop Drawings shall indicate pile splice locations.
- .4 Quality Assurance: Test Reports:
 - .1 Prior to fabrication, and, if requested, provide Departmental Representative with two copies of steel producer's certificates in accordance with CSA-G40.20/G40.21.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Submit details of pile stock material to be used, as described in Section 2 - Products, for review by Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle to prevent damage to products.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver new, undamaged materials to site, accompanied by certified test reports, with manufacturer's logo and mill identification mark provided on pipe piling.
- .4 Storage and Protection:
 - .1 Store and handle pipe piling in accordance with manufacturer's written instructions to prevent permanent deflection, distortion or damage to piles.
 - .2 Support pipe piling on level blocks or racks spaced not more than 3 m apart and not more than 0.60 m from ends.
 - .3 Store pipe piling to facilitate required inspection activities and prevent corrosion prior to installation.
- .5 Waste Management and Disposal:
 - .1 Separate waste materials for disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Vertical (plumb) piles to be 406 mm outer diameter with 12.7 mm wall thickness steel pipe with minimum yield strength of 350 MPa. Dimensional tolerances to ASTM A252 and chemistry to CAN/CSA G40.21-350W. Rolled or seam welded pipe is preferred. Spirally welded pipe is acceptable provided it meets the spiral eccentricity limitations prescribed by API 5L-04 Specification.
- .2 Pile cap plate assembly to CSA-G40.20/G40.21, Grade 350W.

- .3 Pile cap plate assembly 5/8" diameter threaded rod to Grade A307.
- .4 Compatibly sized pipe pile outside cutting shoes: to CSA-G40.20/G40.21, Grade 300W.
- .5 Splices: to CSA-G40.21/G40.21, Grade 350W
- .6 Welding electrodes: to CSA W48.
- .7 Welding and weld testing to CSA W59.
- .8 Cast-in-place concrete to Section 03 30 00 – Cast-in-place Concrete, $f_c' = 45$ MPa.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Connect approved pipe pile cutting shoe to pipe pile as per manufacturer's recommendations.

3.2 FABRICATION

- .1 Fabricate full length piles to eliminate splicing during installation wherever possible.
- .2 The number and location of full strength welded splices shall be approved in writing by Departmental Representative.
 - .1 Use complete joint penetration groove welds. Acceptance criteria for welds shall be as per W59 Section 11, Statically Loaded Structures.
 - .2 Welds shall be visually inspected. All full penetration welds shall be 100% inspected by Radiographic or Ultrasonic methods.
 - .3 Contractor is responsible for the testing of all full strength pile splices.
 - .4 Contractor to provide access and allow time for the Departmental Representative to have a third party testing agency test pile splices (number of splices to be spot checked at the discretion of the Departmental Representative).
- .3 Submit details of planned use of pile material stock to Departmental Representative for approval prior to start of fabrication. Re-use cut-off lengths as directed by Departmental Representative.
- .4 Allowable tolerance on axial alignment to be 0.25% as measured by 3 m straight edge.
- .5 Allowable deviation from straight line over total length of fabricated pile to be 50 mm.
- .6 Install pile cap reinforcement, splices and cutting shoes as indicated.
- .7 Repair defective welds as directed by Departmental Representative.
 - .1 Repairs: to CSA W59.
 - .2 Unauthorized weld repairs may be rejected.

3.3 INSTALLATION

- .1 Install piling in accordance with Section 31 61 13 – Pile Foundations, General Requirements.
- .2 If approved by Departmental Representative, splice piles in place during installation by welding. Hold members in alignment during splicing operation. Make splice by complete joint penetration groove welds as indicated on approved shop drawings.
- .3 Perform internal visual inspection of steel pipe piles, joints and cap prior to placing of concrete. Ensure pipe inside is free from foreign matter. Ensure enough pile cut-off length is provided such that the remaining pile has not been damaged during pile installation.
- .4 Assemble and install reinforcement cages for integral abutments as indicated.
- .5 Install cutting shoes during shop fabrication.
- .6 Piles to be driven within ± 75 mm of theoretical position.

3.4 WELDING

- .1 Weld to CSA W59.
- .2 Welding certification of companies: to CSA W47.1.
- .3 Welding certification of companies welding steel reinforcing bars placed in reinforced concrete: in accordance with CSA W186.

END OF SECTION

Part 1 General

- .1 This section covers the removal of existing asphalt concrete pavement.

Part 2 Products

Not Used.

Part 3 Execution

3.1 PREPARATION

- .1 Prior to commencing removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt concrete pavement to be removed.

3.2 EQUIPMENT

- .1 The cold planing shall be accomplished using a cold-milling machine. The cold-milling machine shall be a self-driven rotating drum type, capable of removing asphalt 100 mm thick and at least 1200 mm wide in a single pass. Cutting depth shall be adjustable from 0 mm to 100 mm over the length of the drum. The machine shall have automatic grade control and be able to load milled material directly into trucks, or be able to windrow the material for subsequent pick-up by other equipment.

3.3 REMOVAL

- .1 Remove existing asphalt pavement to lines and grades as indicated.
- .2 Prior to paving operations commencing, a transverse butt joint must be constructed. If a transverse vertical cut is milled in the existing pavement at the limit of the work area the contractor shall immediately construct with hot mix asphalt concrete a temporary smooth 1.5 m long taper. The temporary taper must be removed prior to paving of the milled area.
- .3 Lanes shall be completed to the same location at the end of the day's cold milling operation where it is intended to have both lanes milled.
- .4 All residue left by the cold planing process shall be removed immediately from the road. Mechanical sweeping shall be performed at the end of each day's operations. Low points in the asphalt as a result of cold planing operations, where water ponding may occur, shall have the shoulder milled for draining rainfall. Any guide rail contaminated as a result of cold planing or sweeping operations shall be cleaned to the satisfaction of the Departmental Representative. Any milled material that is lost over the shoulder shall be immediately retrieved and disposed of in an approved manner.
- .5 The Contractor shall dispose of residue at an approved waste disposal area provided by the Contractor at his own expense.
- .6 The Contractor shall continuously maintain the work site free of pot holes and standing water and in a condition providing for a safe and efficient flow of traffic, from the time of removal, until such time as the new asphalt concrete is placed. Hot mix asphalt concrete

shall be placed in the pot holes; cold mix or RAP is acceptable only as a temporary repair. Areas cold milled must be paved within 7 days of the cold milling operation. Signage indicating the driving condition of the milled surface shall be posted. Milled and aged asphalt concrete surfaces shall be treated with bituminous tack coat in accordance with Section 32 12 13.16 – Asphalt Tack Coat prior to the placing of asphalt concrete.

- .7 Use equipment and methods for removal and hauling which do not tear, gouge, break or otherwise damage or disturb underlying pavement.
- .8 Prevent contamination of removed asphalt concrete pavement and granular base by topsoil, underlying gravel or other materials.
- .9 Provide for suppression of dust generated by removal process.
- .10 Compact underlying material in areas of complete removal of asphalt concrete.
- .11 In areas where localized pavement removal is carried out within the traffic lane ensure traffic is restricted from area until the surface is restored.
- .12 The maximum number of cumulative days that traffic will be permitted to travel on a gravel surface during this project shall not exceed 21 days with not more than 7 consecutive days at any single period of time.

3.4 TRAFFIC CONTROL

- .1 Maintain at least one lane of alternating two-way traffic at construction sites at all times as specified in Section 01 55 26 – Traffic Regulations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 16 – Aggregate Materials

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C127-15, Test Method for Specific Gravity and Absorption of Coarse Aggregate
 - .3 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C535-01, Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .6 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .7 ASTM D5821-13, Standard Test for Determining the Percentage of Fractured Particles in Coarse Aggregate.
 - .8 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m³.
 - .9 ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .10 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .11 ASTM D1557-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m³.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.2-23A, Method of Test for the Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
- .3 Canadian General Standard Board (CGSB)
 - .1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.
- .4 Ministry of Transportation Ontario (MTO)
 - .1 MTO LS-618, Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 31 05 16 – Aggregate Materials.
- .2 Stockpile minimum 50% of total aggregate required prior to beginning operation. Maintain minimum of 1000 tonne in stockpile until last 1000 tonne is placed.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base material (Granular B): Crushed and screened quarried rock. Material to consist of hard and durable stone and sand particles. Material shall be tested in accordance with ASTM C117 and ASTM C136 and shall conform to the following gradation table:

<u>Sieve Size mm</u>	<u>Percent Pass</u>
50.8	100
25.4	50 - 100
4.76	20 – 55
1.2	10 - 35
0.3	5 – 20
0.075	2 - 8

- .2 Granular material shall conform to the physical properties requirements listed in the following table:

<u>Property</u>	<u>Test Method</u>	<u>Sub-base</u>
Absorption (% Maximum)	ASTM C127	1.75
Los Angeles Abrasion* (loss % Maximum)	ASTM C131	35
Fractures Particles, one face, (% Minimum)**	ASTM D5821	80
Plasticity Index	ASTM D4318	0
Petrographic Number (Maximum)	ASTM C295	150
Micro-Deval Test for Fine Aggregate (% Max.)	CSA A23.2-23A	30
Micro-Deval Test for Coarse Aggregate (% Max.)	MTO LS-618	25

*The rates of loss after 100 revolutions to the loss after 500 revolutions shall not exceed 0.280.

**The fractured particle shall have at least one well defined fresh face resulting from fracture, with the face comprising no less than 20% of the particle surface area. Particles with smooth faces and rounded edges, or with only small chips removed will not be

considered as fractured.

- .3 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction.
- .4 Materials shall conform to the gradation requirements and to the physical requirements stated. The gradation shall not show marked fluctuations from opposite extremes of the limiting sizes, and the plotted curve shall flow in a manner free from acute changes in direction.

Part 3 Execution

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Place and compact shouldering to match cross slope.
- .11 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 100% maximum dry density attained using the method prescribed herein as "Control Strip".
- .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.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

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

3.3 CONTROL STRIP METHOD

- .1 A Control Strip is a lift of granular sub-base course constructed on a 30 m section, minimum 3 m wide, of prepared surface selected by the Departmental Representative.
- .2 A maximum dry density "Control Density" shall be established on a lift of granular sub-base course using the equipment and method of compaction as prescribed herein for construction of a Control Strip.
- .3 A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. Each Control Strip shall remain in place and become a portion of the completed sub-base course.
- .4 No additional lift shall be placed until the control density is determined and the compacted lift is approved by the Departmental Representative.
- .5 The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Departmental Representative. The surface of the granular sub-base course shall be kept moist until testing is complete.
- .6 To determine the Control Density, a minimum of six moisture and density tests shall be taken at random locations by the Departmental Representative, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.
- .7 The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted.
- .8 Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in a vibratory mode, at a speed not exceeding 8 km/h.
- .9 Control Density Determination.
 - .1 A lift of granular sub-base course shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements of the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.
 - .2 A pass shall be one complete coverage of the Control Strip layer with the compaction equipment.
 - .3 Testing of the Control Strip shall be discontinued when the average dry density between each series of passes increases by less than 10 kg/m^3 , continually decreases, or remains constant.
 - .4 The maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

3.4 SITE TOLERANCES

- .1 Finished sub-base surface to be within a tolerance of +/-20 mm of dimensions as indicated but not uniformly high or low.

3.5 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding material is constructed, or until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 16 – Aggregate Materials

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C127-15, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .3 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C535-01, Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .6 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .7 ASTM D5821-13, Standard Test for Determining the Percentage of Fractured Particles in Coarse Aggregate.
 - .8 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m³.
 - .9 ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .10 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .11 ASTM D1557-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m³.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.2-23A, Method of Test for the Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
- .3 Canadian General Standard Board (CGSB)
 - .1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.
- .4 Ministry of Transportation Ontario (MTO)
 - .1 MTO LS-618, Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
 - .2

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 31 05 16 – Aggregate Material.
- .2 Store minimum 50% of total aggregate required prior to beginning operation. Maintain minimum of 1000 tonne in stockpile until last 1000 tonne is placed.

Part 2 Products

2.1 MATERIALS

- .1 Aggregate base material (Granular A): Crushed and screened quarried rock. Material to consist of hard and durable stone and sand particles. Material shall be tested in accordance with ASTM C117 and ASTM C136 and shall conform to the following gradation table:

Sieve Size mm Percent Pass

19	100
9.51	50 – 80
4.76	35 – 60
1.2	15 – 35
0.3	5 – 20
0.075	2 - 8

- .2 Granular material shall conform to the physical properties requirements listed in the following table:

<u>Property</u>	<u>Test Method</u>	<u>Sub-base</u>
Absorption (% Maximum)	ASTM C127	1.75
Los Angeles Abrasion* (loss % Maximum)	ASTM C131	35
Fractures Particles, one face, (% Minimum)**	ASTM D5821	80
Plasticity Index	ASTM D4318	0
Petrographic Number (Maximum)	ASTM C295	150
Micro-Deval Test for Fine Aggregate (% Max.)	CSA A23.2-23A	30
Micro-Deval Test for Coarse Aggregate (% Max.)	MTO LS-618	25

*The rates of loss after 100 revolutions to the loss after 500 revolutions shall not exceed 0.280.

**The fractured particle shall have at least one well defined fresh face resulting from fracture, with the face comprising no less than 20% of the particle surface area. Particles with smooth faces and rounded edges, or with only small chips removed will not be considered as fractured.

- .3 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction.
- .4 Materials shall conform to the gradation requirements and to the physical requirements stated. The gradation shall not show marked fluctuations from opposite extremes of the limiting sizes, and the plotted curve shall flow in a manner free from acute changes in direction.

Part 3 Execution

3.1 PLACING

- .1 Place aggregate base after granular sub-base is inspected and approved by Departmental Representative.
- .2 Construct aggregate base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading aggregate base material on crown line or high side of one-way slope.
- .6 Place aggregate base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Place and compact shouldering to match cross slope. Compacted shouldering to be flush with asphalt concrete surface.
- .11 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 100% maximum dry density attained using the method prescribed herein as "Control Strip".

- .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.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 CONTROL STRIP METHOD

- .1 A Control Strip is a lift of aggregate base course constructed on a 30 m section, minimum 3 m wide, of prepared surface selected by the Departmental Representative.
- .2 A maximum dry density "Control Density" shall be established on a lift of aggregate base course using the equipment and method of compaction as prescribed herein for construction of a Control Strip.
- .3 A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. Each Control Strip shall remain in place and become a portion of the completed base course.
- .4 No additional lift shall be placed until the control density is determined and the compacted lift is approved by the Departmental Representative.
- .5 The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Departmental Representative. The surface of the aggregate base course shall be kept moist until testing is complete.
- .6 To determine the Control Density, a minimum of six moisture and density tests shall be taken at random locations by the Departmental Representative, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.
- .7 The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted.
- .8 Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in a vibratory mode, at a speed not exceeding 8 km/h.
- .9 Control Density Determination.
 - .1 A lift of aggregate base course shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements of the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.
 - .2 A pass shall be one complete coverage of the Control Strip layer with the compaction equipment.
 - .3 Testing of the Control Strip shall be discontinued when the average dry density between each series of passes increases by less than 10 kg/m^3 , continually decreases, or remains constant.

- .10 The maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

3.4 SITE TOLERANCES

- .1 Finished aggregate base surface to be within a tolerance of +/-10 mm of dimensions as indicated but not uniformly high or low.

3.5 PROTECTION

- .1 Maintain finished aggregate base in condition conforming to this section until succeeding material is constructed, or until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 07 14 13 – Hot Fluid-Applied Rubberized Asphalt Waterproofing
- .4 Section 32 12 16 – Asphalt Paving
- .5 Section 32 12 18 – Asphalt Concrete Paving of Bridge Decks

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D140-01, Standard Practice for Sampling Bituminous Materials.
 - .2 ASTM D244-09, Test Methods for Emulsified Asphalts.
 - .3 ASTM D977-13e1, Standard Specification for Emulsified Asphalt.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- .3 Newfoundland and Labrador Department of Transportation and Works (NLDTW)
 - .1 NLDTW Specifications Book.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit two – 1L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars made with plastic to Departmental Representative at least 2 weeks prior to beginning work.
- .3 Sample asphalt tack coat material to: ASTM D140.
- .4 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.

1.4 QUALITY ASSURANCE

- .1 Upon request by Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with ASTM D140.
- .2 Provide, maintain and restore asphalt storage area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.

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

Part 2 Products

2.1 MATERIALS

- .1 Anionic emulsified asphalt: to ASTM D977 Type SS-1 or SS-1h.
- .2 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor to be:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5 m.
 - .3 Applied at readily determined and controlled rates with uniform pressure.
 - .4 Distributed in uniform spray without atomization at temperature required.
 - .2 Equipped with meter, registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .3 Equipped with pump having flow meter graduated in units of 5L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
 - .4 Equipped with an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .5 Equipped with accurate volume measuring device or calibrated tank.
 - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .7 Equipped with nozzle spray bar, with operational height adjustment.
 - .8 Cleaned if previously used with incompatible asphalt material.

Part 3 Execution

3.1 APPLICATION

- .1 Obtain Departmental Representative's approval of surface before applying asphalt tack coat.
- .2 Apply asphalt tack coat only on clean and dry surface.
- .3 Apply asphalt tack coat evenly to pavement surface at rate of 0.14 litres/m² or as directed by Departmental Representative.
- .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

- .5 Do not apply asphalt tack coat when air temperature is less than 10 degrees C or when rain is forecast within 2 hours of application.
- .6 Apply asphalt tack coat only on unfrozen surface.
- .7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
- .9 Tack coat shall only be applied to the extent that it can be covered with asphalt concrete prior to the end of the day.
- .10 Keep traffic off tacked areas until asphalt tack coat has set.
- .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .12 Permit asphalt tack coat to set before placing asphalt pavement.
- .13 Provide advance warning to adjacent landowners of tack operations schedule.
- .14 Provide adequate signage to warn general public of tack application. Provide adequate personnel to assist the public in avoiding walking through tacked areas and subsequent damage to footwear and tracking into buildings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 32 01 16 – Removal of Existing Asphalt
- .4 Section 32 12 13.16 – Asphalt Tack Coat
- .5 Section 32 12 18 – Asphalt Concrete Paving of Bridge Deck

1.2 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
 - .4 AASHTO T283, Standard Method of Test for Resistance of Compacted Hot Mix Asphalt to Moisture-Induced Damage.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-14, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-15, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C207-06 (2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM C1252-17, Standard Test Methods for Uncompacted Void Content of Fine Aggregate.

- .10 ASTM D242, Standard Specification for Mineral Filler for Bituminous Paving Mixtures
- .11 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- .12 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .13 ASTM D3203-11, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- .14 ASTM D4791-10, 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-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
- .5 Newfoundland and Labrador Department of Transportation and Works Highway Design Division Specifications Book.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C at least 4 weeks prior to beginning Work.
 - .3 Submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.
 - .4 Submit manufacturer's test data and certification that hydrated lime meets requirements of this Section.
 - .5 Submit asphalt concrete mix design and trial mix test results, stamped by professional engineer registered or licensed in Province of Newfoundland and Labrador, to Departmental Representative for review at least 4 weeks prior to beginning work.
 - .6 Submit current testing reports (dated within the last year) for physical properties of the proposed aggregates prepared by certified third party inspection agency for inspection and testing and provide access for sampling.
 - .7 Submit Contractor's current Provincial Asphalt Plant Approval Permit to Departmental Representative for review at least 4 weeks prior to beginning work.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to beginning Work.

- .3 Submit samples of following materials proposed for use at least 4 weeks prior to beginning Work.
 - .1 One 5 L container of asphalt cement.
 - .2 90 kg of hydrated lime.

1.4 WASTE MANGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.
- .2 Divert unused asphalt from landfill to facility capable of recycling materials.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt Tack Coat: in accordance with Section 32 12 13.16 – Asphalt Tack Coat.
- .2 Asphalt Binder: Performance Graded Asphalt Binder PG58-28, in accordance with NLDTW Specification Book Section 330 – Hot Mix Asphalt Concrete.
- .3 Asphalt material: hot mixed, hot-laid combination of mineral aggregates, uniformly coated and mixed with an asphaltic binder in a suitable mixing plant. Asphalt materials and aggregates shall meet the requirements of Division 3, Section 330 of NLDTW Specifications Book.
- .4 Composition of asphalt mixture: to grading and asphalt content requirements in Division 3, Section 330 of the NLDTW Specifications Book, Base Course and Surface Course, as indicated.

2.2 EQUIPMENT

- .1 Mixing Plants: All plants shall conform to the requirements of ASTM D995 Standard Specification for Mixing Plants for Hot-Mixed, Hot Laid Bituminous Paving Mixtures and in accordance with NLDTW Specification Book Section 330 – Hot Mix Asphalt Concrete.
- .2 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .3 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .4 Vibratory rollers:
 - .1 Drum diameter: 1200 mm minimum.
 - .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .5 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.
- .6 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass not less than 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.
- .7 Plant testing facility: provide laboratory space at plant site for exclusive use of Departmental Representative, for performing tests, keeping records and making reports.
- .8 Material transfer vehicle: capable of transferring while doing some reblending of the paving material to allow for non-contact continuous paving. Material Transfer Device shall be used in the placement of all asphalt concrete on this project.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Reshape granular roadbed in accordance with Section 32 11 23 Aggregate Base Courses.
- .3 When paving over existing asphalt surface, clean pavement surface to approval of Departmental Representative.
 - .1 When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .4 Apply tack coat in accordance with Section 32 12 13.16 Asphalt Tack Coat, prior to paving.
- .5 Prior to laying mix, clean surfaces of loose and foreign material.

3.2 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.

- .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
 - .1 Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 135 degrees C.

3.3 TEST STRIP

- .1 Construct and test strip to approval of Departmental Representative.
- .2 Construct test strip with at least 500 tonnes of mix, and involving more than one lane, so that joint finishing techniques can be established.
- .3 Construct test strip in consultation with Departmental Representative.
- .4 During construction of test strip, Departmental Representative will establish optimum rolling pattern by taking nuclear densometer readings and observations to:
 - .1 Determine sequence and number of passes.
 - .2 Determine correct operating characteristics of vibratory rollers.
 - .3 Determine maximum density of asphalt mix.
 - .4 Ensure smooth surface finish.
 - .5 Establish actual density achieved by coring in order to determine if additional or other rolling equipment is required to achieve density of not less than 98 % of density obtained with Marshall specimens prepared from samples of mix being used.

3.4 PLACING

- .1 Obtain Departmental Representative's approval of base prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated in accordance with Division 3, Section 330 of NLDTW Specifications Book and as herein specified.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 7 degrees C minimum, unless approved by Departmental Representative.
 - .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 indicated.

- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Place individual strips no longer than 500 m.
- .7 Spread and strike off mixture with self propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .1 Departmental Representative to establish lines for paver to follow parallel to centerline of proposed pavement. 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.
 - .1 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.
 - .1 Remove excess material forming high spots using shovel or lute.
 - .1 Fill and smooth indented areas with hot mix.
 - .2 Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.
- .8 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.
 - .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly without broad casting material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.
 - .1 Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

3.5 COMPACTING

- .1 Compact asphalt concrete in accordance with Division 3, Section 330 of NLDTW Highway Design Specifications Book.

3.6 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
 - .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.
 - .4 Construct butt joints as indicated.

3.7 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 6 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 6 mm when checked with 4.5 m straight edge placed in any direction.

3.8 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section consists of the application of asphalt concrete on the bridge deck and approach slabs after the waterproofing membrane and tack coat are applied.

1.2 RELATED SECTIONS

- .1 Section 07 14 13 – Hot Fluid-Applied Rubberized Asphalt Waterproofing
- .2 Section 32 12 13.16 – Asphalt Tack Coat
- .3 Section 32 12 16 – Asphalt Paving

1.3 REFERENCES

- .1 Newfoundland and Labrador Department of Transportation and Works (NLDTW)
 - .1 NLDTW Specifications Book.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt Tack Coat: Emulsified Asphalt in accordance with Section 32 12 13.16 – Asphalt Tack Coat
- .2 Asphalt Binder: Performance Graded Asphalt Binder PG58-28, in accordance with NLDTW Specification Book Section 330 – Hot Mix Asphalt Concrete.
- .3 Asphalt Concrete: hot mixed, hot-placed combination of mineral aggregates, uniformly coated and mixed with an asphaltic binder in a suitable mixing plant. Asphalt materials and aggregates shall meet the requirements of NLDTW Specification Book Section 330 – Hot Mix Asphalt Concrete and Section 922 – Asphaltic Paving of Bridge Decks and Approaches.
- .4 Composition of Asphalt Concrete: to grading and asphalt content to meet requirements of NLDTW Specification Book Section 330 – Hot Mix Asphalt Concrete, Surface Course gradation and quality.

Part 3 Execution

3.1 CONSTRUCTION

- .1 Equipment, Transportation of Mix, Placing and Compacting to be in accordance with Section 32 12 16 – Asphalt Paving.
- .2 Apply tack coat in accordance with Section 07 14 13 – Hot Fluid-Applied Rubberized Asphalt Waterproofing.

- .3 Apply a tack coat of SS-1 or SS-1h emulsion to asphalt surface prior to placing the next lift of mix.
- .4 Place asphalt concrete paving of bridge deck and approach slabs in accordance with manufacturer's specifications of bridge deck waterproofing.
- .5 The deck shall be paved with Surface Course gradation and quality Asphalt Mix at 2 lifts of 40 mm / lift.
- .6 Trucks or pavers shall not start, stop or turn too quickly on the deck as it is could cause a rupture of the waterproofing. The paver shall travel at a maximum speed of 4 m per minute to provide maximum traction.
 - .1 Material Transfer Vehicle (MTV) shall be used in the placement of all asphalt concrete on this project.
- .7 Breakdown rolling of the asphalt concrete shall commence when the mat cools to 105°C, using a steel wheel roller weighing a minimum of 7 ton. The steel wheel roller shall make only one pass over the mat, running off the deck to stop and turn. Vibratory rollers are not permitted to be used on bridge decks. Final rolling shall be performed with a rubber-tired roller, also running off the deck to stop and turn.
- .8 The final lift of asphalt mix shall provide a smooth transition between bridge and approaches.
- .9 Within 24 hours of paving of the deck and approach slabs, seal the interface between the asphalt concrete and the face of the curb by pouring waterproofing along the joint such that the material extends 25 to 50 mm from the face of the curb and to a thickness of 2 to 4 mm above the asphalt concrete.
- .10 Finish Tolerances and Defective Work to be in accordance with Section 32 12 16 – Asphalt Paving.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section consists of the application of water to the surface of the work to suppress dust.

1.2 RELATED SECTIONS

- .1 Section 31 24 13 - Roadway Embankments
- .2 Section 32 11 16.01 - Granular Sub-Base
- .3 Section 32 11 23 - Aggregate Base Courses

Part 2 Products

2.1 MATERIALS

- .1 Water: in accordance with Departmental Representative's approval.

Part 3 Execution

3.1 APPLICATION

- .1 Apply water with equipment approved by Departmental Representative at rate of 1L/m² for liquid when directed by Departmental Representative.
- .2 Failure of the Contractor to provide adequate dust control measures resulting in suspension of Work will be the responsibility of the Contractor.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This standard applies to low temperature, water-borne, acrylic, fast drying traffic paints suitable for spray application with specialized equipment, to asphalt surfaces. Included are centre lines to match existing layout (double solid, solid/dash or single dash lines), two shoulder lines, as well as all intersections, arrows, delineation, special marking and temporary markings, etc., for the full length of the work area.
- .2 This specification includes a compound to be used as an additive in conjunction with water-borne traffic paint and glass spheres to provide a drying agent which accelerates the no-tack time of the water-borne traffic paint. No-tack time is to be increased by approximately 40% over the same paint without the compound.
- .3 All pavement markings to be in accordance with the Manual of Uniform Traffic Devices for Canada, latest edition.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 711, Test Method for No-Pick-Up Time of Traffic Paint.
 - .2 ASTM D 868, Test Method for Evaluating Degree of Bleeding of Traffic Paint.
 - .3 ASTM D 869, Test Method for Evaluating Degree of Settling of Paint.
 - .4 ASTM D 969, Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
 - .5 ASTM D 1155, Test Method for Roundness of Glass Spheres.
 - .6 ASTM D 1210, Test Method for Fineness of Dispersion of Pigment-Vehicle Systems.
 - .7 ASTM D 1214, Test Method for Sieve Analysis of Glass Spheres.
 - .8 ASTM D 1309, Test Methods for Settling Properties of Traffic Paints During Accelerated Storage.
 - .9 ASTM D 2205, Guide for Selection of Tests for Traffic Paints.
 - .10 ASTM D 2243, Test Method for Freeze-Thaw Resistance of Water-Borne Coatings.
 - .11 ASTM D 3960, Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
 - .12 ASTM E 97, Test Method for Directional Reflectance Factor of Opaque Specimens by Broad-Band Filter Reflectometry.
- .2 Canadian General Standards Board (CGSB)
 - .1 CBSB Specification 1-GP-71, Refractive Index
- .3 Transportation Association of Canada (TAC)
 - .1 Manual of Uniform Traffic Control Devices for Canada.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Mark samples with name of project, location, paint manufacturer’s name and address, name of paint, CGSB specification number and formulation number and batch number.
- .3 The Departmental Representative reserves the right to test samples of paint at the point of delivery, from any or all batches of paint to be used. The samples will be tested and all paint from any batch tested that does not meet specifications, will not be permitted to be used on this project.

Part 2 Products

2.1 MATERIAL

- .1 General Requirements:
 - .1 The low temperature, water-borne (acrylic), lead free, fast drying traffic paints shall be designed to be applied in environmental conditions such that operational temperatures shall be in the range of 2 degrees Celcius and rising.
 - .2 Paint shall be well ground to a uniform smooth consistency and shall be free from skin, dirt and other foreign particles. The paint shall be capable of being sprayed at the temperature intended for the paint. It shall flow evenly and smoothly and cover solidly when applied to pavement. The paint shall be supplied ready-mixed for use without any addition of water.
 - .3 The paint mixture shall include the glass bead intermix system.
 - .4 The paint mixture is to be able to be applied under pneumatic pressure by a standard truck mounted dispensing machine moving at speeds of 8 to 24 km/hr.

2.2 PAINT

- .1 Paint to this standard shall comply with the following detail requirements when tested in accordance with the specified test methods:

<u>Property</u>	<u>Specification</u>		<u>Test Method (1)</u>
	<u>Min.</u>	<u>Max</u>	
General:			
Density	-	-	Method 2.1
Consistency, KU (2)	85	95	Method 4.5
Skinning Properties (3)	0	0	Method 10.1
Contrast Ratio (5)	0.992		
VOC (6)		150g/L	ASTM D3960
Volatile Matter % (mass) (including water)		24	Method 17.1
Freeze-thaw resistance	Pass		ASTM D2243
Pigment Content, % (mass)	56	62	Method 21.2
Binder solid, % of mass	16.75		Method 19.1

100% Acrylic Polymer, % (mass)	15	-	Method 57.1
No-pick-up time, min. (4)	1	5	ASTM D711
Non-tracking time, sec. (8)		60	
Fineness of grind, HU	3	-	ASTM D1210
Coarse Particles:			
#60 Sieve – 250 µm	nil	nil	ASTM D185
#100 Sieve – 150 mm	-	0.01	ASTM D2205
Bleeding	4	-	ASTM D869 & ASTM D2205
Settling Rate	6	-	ASTM D1309
	8	-	ASTM D869
White Paint:			
Titanium Dioxide, g/L	150	-	Method 2.1, 21.1, 50.14
Titanium Dioxide Pigment (7) Reflectance	80	-	ASTM E97
Colour	-	-	1-GP-12C 513-301
Yellow Paint:			
Reflectance	60	-	ASTM E97
Colour	-	-	505-308 (approx.)

- .1 All tests to be performed by methods as per Canadian General Standards Board (CGSB), 1-GP-71 or American Society of Testing and Materials (ASTM) or as noted herein.
- .2 Krieb units at 25°C.
- .3 Paint shall be non-skinning. (See General Requirements, 2.1.1.2).
- .4 Perform field tests on a 15 mil wet film thickness of hot spray (maximum 50°C). Wait one minute, drive a passenger vehicle over the film and ensure no visible (from 15 m) deposition of paint is deposited onto the adjacent pavement.
- .5 Contrast Ratio: apply a wet film thickness of 381 microns on Laneta Penopac form (1B). Drying Time: Minimum 24 hours at 23°C (plus or minus 2°C).
- .6 Volatile organic compounds (VOC) (excluding water): max. 150 g/L; method ASTM D3960.
- .7 Titanium dioxide pigment shall be Rutile type and have a minimum TiO₂ content of 93%.
- .8 Non-tracking time based upon 375 µm (15 mils) wet film thickness applied when pavement temperature is greater than 10°C and humidity conditions of 80% or less on dry pavement.

2.3 GLASS BEAD INTERMIX SYSTEM

- .1 The compound shall be a mixture of glass beads and drying agent materials.
- .2 The compound shall meet the following gradation when tested according to ASTM D 1214:

<u>Sieve Size</u>	<u>% Passing</u>
0.850 mm	100%
0.600 mm	80 – 100%
0.300 mm	20 – 35%
0.150 mm	0 – 8%
0.075 mm	0 – 2%

- .3 The glass bead component of the compound shall be colourless, clean, transparent, and free from milkiness and excessive air bubbles. They shall be spherical in shape, containing no more than 25% irregularly shaped particles and be the equivalent of an AASHTO Type I glass bead. The silica content of the glass spheres shall not be less than 60% as per ASTM C169 testing. The component shall be manufactured of glass of a composition designed to be highly resistant to traffic wear, decomposition, etching under atmospheric conditions, dilute acids, alkalids, paint film constitutes, and to the effect of weathering, and should be composed of recycled glass (to the maximum extent possible).
- .4 The drying agent component shall be smooth and spherically shaped, amber to white in colour, and of a type that promotes accelerated coalescence of the latex polymer and as such reduces water-borne paint dry to touch time by approximately 40% minimum.
- .5 The compound shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps. It shall flow freely from dispensing equipment at any time when applying with pavement marking.

Part 3 Execution

3.1 EQUIPMENT REQUIREMENTS

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONDITION OF SURFACES

- .1 Surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.3 TRAFFIC CONTROL

- .1 Traffic control to be in accordance with Section 01 55 26 – Traffic Regulation.

3.4 APPLICATION

- .1 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 h.
- .2 Apply traffic paint evenly at rate of 3 m/L.
- .3 Do not thin paint unless approved by Departmental Representative.
- .4 Symbols to conform to dimensions indicated.
- .5 Thoroughly clean distributor tanks before refilling with paint of different colour.

3.5 TOLERANCE

- .1 Paint markings to be within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings to approval of Departmental Representative.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 To complete finish grading to contours and elevations as shown on Drawings, as specified, or as required, and summarized but not restricted to:
 - .1 Preparation of Subgrade for areas to be hydroseeded.
 - .2 Preparation of Subgrade, provision and placement of planting soil mixture in planting pits.

1.2 RELATED WORK

- .1 Section 01 35 43 Environmental Procedures
- .2 Section 31 24 13 Roadway Embankments
- .3 Section 32 92 19.16 Hydraulic Seeding
- .4 Section 32 93 10 Planting of Trees, Shrubs, and Groundcovers

1.3 REFERENCES

- .1 ASTM D698-12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))

1.4 SOURCE QUALITY CONTROL

- .1 Protect site, soils and imported material from contamination by invasive plant species. Remove all invasive plant species introduced to the work site. Invasive plant species is defined as vegetative material not native to nor currently found within the project site and which aggressively spreads, is fast growing and/or is difficult to eradicate, such as Japanese knotweed, purple loosestrife, goutweed, glossy buckthorne, scotch pine, garlic mustard, etc.
- .2 The Contractor shall submit representative samples of planting soil that is to be used on the project to a Soil Plant Testing Laboratory acceptable to the Departmental Representative. Prior to using these materials on site they must meet the requirements as indicated in the project specifications. Information to be obtained from testing includes the following:
 - .1 Soil type classification.
 - .2 Percent organic matter.
 - .3 Chemical soil test.
 - .4 Recommendation for soil amendments and fertilizers.
- .3 Contractor to pay for costs of testing.
- .4 Perform pH test to determine required treatment to bring pH value of soil to 6.0 to 7.5 level

- .5 Submit two copies of soil analysis and recommendations for corrections to Departmental Representative.

1.5 SCHEDULING

- .1 No planting soil is to be placed before soil testing results have been provided by Contractor and approved by the Departmental Representative.

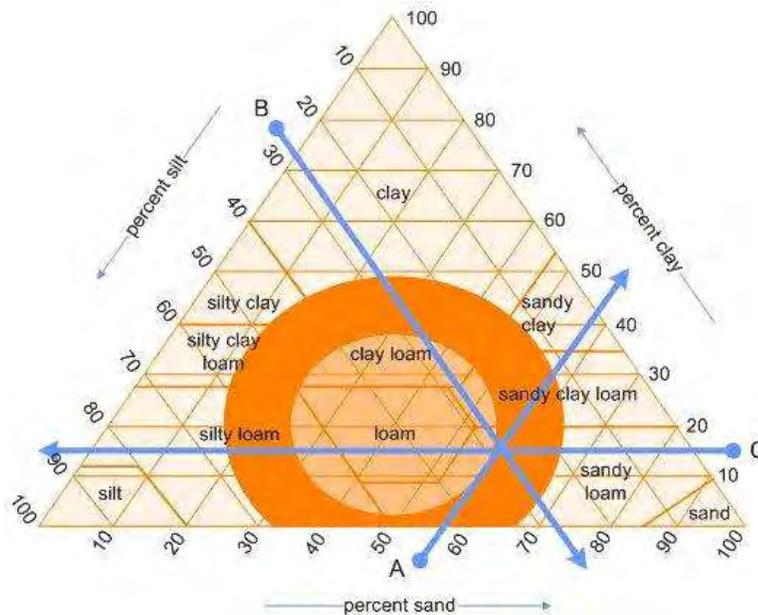
1.6 PROTECTION

- .1 Prevent damage to trees, landscaping, natural features, bench marks, existing pavement, culverts, and utility lines which are to remain. Make good any damage.
- .2 Protect newly graded and filled areas from washouts and settlements caused by rain and water drainage. Fill and grade settled or washed out areas to required levels and slopes under Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Topsoil shall conform to the following characteristics unless otherwise specified. Be natural, fertile, friable and classified as either a loam or sandy loam texture as per Standard Topsoil Triangle.



- .2 Planting soil shall contain not less than 20%, or more than 40%, by weight of decayed organic matter (humus). All materials shall be taken from a well drained, arable site, free from subsoil, debris, vegetation, toxic materials, and stones and roots over 25mm max. dimension. Planting soil shall be free of grassy weeds such as quack grass and noxious weeds. Material shall have a pH of between 6.0 and 7.5. If material does not meet

minimum specifications it must be amended with an approved material and tested at the expense of the Contractor.

- .3 Manure: Well rotted, unleached cattle manure, not less than eight months or more than two years old, free of harmful chemicals and substances, containing no more than 25% straw, leaves or other materials unsuitable for planting use.
- .4 Peat moss:
 - .1 Derived from partially decomposed fibrous or cellular stems and leaves of sphagnum mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could inhibit growth.
 - .4 Shredded particle minimum size 6mm.
- .5 Bonemeal: Raw bonemeal, finely ground with a minimum analysis of 2% nitrogen and 20% phosphoric acid.
- .6 Planting Soil Mixture for trees and shrubs. Planting soil can be manufactured by mechanically mixing: 6 parts topsoil, with 1 part well-rotted manure, and 3 parts peat moss.
 - .1 Incorporate bonemeal at rate of 2.75 kg per cu. meter
 - .2 Incorporate fertilizer at rate determined by soil sample test.
 - .3 Landscape Treatment 1 – Planting Soil Medium to consist of 100% planting soil.
 - .4 Landscape Treatment 2 & 3 – Planting Soil Medium to consist of 50% planting soil and 50% existing organic/graded material.

Part 3 Execution

3.1 GENERAL

- .1 Establish Subgrade for new planting areas by excavating/filling to indicated grades with existing organic/granular material.
- .2 Consolidate each layer to minimum 95% Standard Proctor Density.
- .3 Establish areas of proposed tree reinstatement and shrub reinstatement with Departmental Representative.
- .4 Imported planting soil shall be free of invasive plant species. Source of topsoil is to be inspected prior to arrival on site so as to permit inspector to see species growing in soil.

3.2 PREPARATION OF SUBGRADE & FINISH GRADING

- .1 Grade Subgrade, eliminating uneven areas and low spots, ensuring positive drainage. Remove soil contaminated with toxic materials. Dispose of removed materials from site as required by the Newfoundland Department of Environment.

- .2 Cultivate entire area that is to receive hydroseeding to depth of 100mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted soil.
- .3 Remove surface debris, roots, vegetation, branches and stones in excess of 75mm dimension.

3.3 PREPARATION OF PLANTING PITS

- .1 Excavate planting pits for new planting to dimensions and spacing indicated on Drawings.
- .2 Plant new material and backfill with planting soil mixture. Refer to Section 32 93 10.

3.4 SURPLUS MATERIALS

- .1 Dispose of surplus topsoil not required for fine grading and landscaping off-site.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures

1.2 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Submit statement which certifies that each bag of seed and each bag of fertilizer for use on this project is fully labeled in accordance with the Canada Seed Act and Fertilizer Act.
 - .3 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
 - .4 Submit in writing to Departmental Representative 10 days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
- .2 Hydraulic seeding shall be carried out as soon as possible after completion of the surface preparation in order to prevent erosion by wind and water. Hydraulic seeding shall take place no more than two (2) weeks after excavation and embankment construction is complete.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:

- .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
- .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
 - .1 Store fertilizer in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIAL

- .1 Seed: “Canada pedigreed grade” in accordance with Government of Canada Seeds Act and Seeds Regulations.
 - .1 Grass mixture: “Certified”, “Canada No. 1 Lawn Grass Mixture” in accordance with Government of Canada “Seeds Act” and “Seeds Regulations”.
 - .2 Mixture composition: 60% Annual Rye and 40% Creeping Red Fescue.
- .2 Mulch: Specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, with an environmentally acceptable dye, free of germination and growth inhibiting factors with following properties:
 - .1 Type I mulch.
 - .1 Made from wood cellulose fibre.
 - .2 Organic matter content: 95% plus or minus 0.5%.
 - .3 Value of PH: 6.0.
 - .4 Potential water absorption: 900%.
 - .2 Tackifier: Water dilutable, liquid dispersion water soluble vegetable carbohydrate powder.
- .3 Water: Free of impurities that would inhibit germination and growth.
- .4 Fertilizer:
 - .1 To Canada “Fertilizers Act” and “Fertilizers Regulations”.
 - .2 The fertilizer is to have a plant food ratio of 10 nitrogen, 10 phosphorus and 20 potash plus 2% Fritted Tract Elements.
 - .3 The fertilizer to be spread the following spring during the maintenance period shall have a plant food ratio of 5 nitrogen, 10 phosphorus and 30 potash.

- .5 Inoculants: Inoculant containers to be tagged with expiry date.

2.2 EQUIPMENT

- .1 Truck (hydraulic):
 - .1 Slurry tank: approved commercial hydraulic equipment.
 - .1 Capable of continually agitating the mixture during hydraulic seeding operation to ensure homogeneous slurry is produced.
 - .2 Pumps capable of maintaining continuous non-fluctuating flow of solution.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.
- .2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Departmental Representative.
- .3 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .4 Protect seeded areas from trespass until plants are established.

3.2 PREPARATION OF SURFACES

- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Fine grade areas to be seeded free of humps and hollows.
- .3 Remove deleterious materials such as sticks, roots, or large rocks and loosen top 50 mm of soil to remove hardened or crusted soil.
- .4 Surface to be scarified parallel to the contour of the slope with a minimum indentation of 25 mm and at a maximum spacing of 150 mm.
- .5 Cultivated areas identified as requiring cultivation to depth of 25 mm.
- .6 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .7 Obtain Departmental Representative's approval of grade before starting to seed.

3.3 PREPARATION OF SLURRY

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.4 HYDRAULIC SEEDING

- .1 Seed during local growing season when natural moisture is available and temperature is suitable to ensure germination and growth.
- .2 Measure all quantities of material by weight or by weight-calibrated volume measurement.
- .3 Charge seeder with water, and while agitating, slowly add mulch, seed, fertilizer and lime until all components are thoroughly mixed.
- .4 When required, add erosion control agent to seed and mix thoroughly to complete seeding slurry.
- .5 Slurry application per hectare:
 - .1 Seed: Grass mixture 125 kg.
 - .2 Fertilizer: 375 kg.
 - .3 Mulch: Type I 1350 kg.
 - .4 Tackifier: 300 kg.
 - .5 Water: Minimum 30,000 litres.
- .6 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - .1 Use correct nozzle for application.
 - .2 Using hoses for surfaces difficult to reach and to control application.
 - .3 Blend application 300 mm into adjacent grass areas or sided areas and previous applications to form uniform surfaces.
 - .4 Slurry shall be thick enough to prevent grass seed from drying and blowing but not to impact germination and growth.
 - .5 Reshoot areas where application is not uniform.
 - .6 Remove slurry from items and areas not designated to be sprayed.
 - .7 Protect seeded areas from trespass satisfactory to Departmental Representative.
 - .8 Remove protection devices as directed by Departmental Representative.

3.5 MAINTENANCE DURING ESTABLISHED PERIOD

- .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
- .2 The contractor shall be responsible for maintaining hydraulic seeded areas to ensure proper and adequate growth of the vegetation during the warranty period. The contractor shall also be responsible for an additional application of fertilizer the following spring after initial application. This application shall be by a method approved by the Departmental Representative. The fertilizer shall be 5-10-30 and shall be at a rate of 300 kg/ha. No additional payment will be made for maintenance on the extra application of fertilizer.

3.6 ACCEPTANCE OF HYDROSEED APPLICATION FOR PARTIAL PAYMENT

- .1 Hydroseeded areas will be accepted for payment provided:

1. Seeded areas are uniformly established and turf is free of rutted, eroded, bare or dead spots.
2. Seeded areas have established to 50% coverage, i.e. 50% of soil surface soil is visible when grass has been cut to 75 mm height.
3. Areas seeded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.7 WARRENTY PERIOD

- .1 All areas hydraulic seeded under this contract shall have a warranty period of one (1) year starting from the date of initial acceptance. This warranty shall cover any defects in materials and workmanship, and damages caused by the elements of weather. During this period, any defect brought to the attention of the Contractor by the Departmental Representative shall be fixed, repaired or made good to the satisfaction of the Departmental Representative and at no additional cost.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures

1.2 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets, processed products, and tackifier.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule dry mulching to coincide with preparation of soil surface.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of processed material identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
 - .1 Material should not be so wet, decayed or compacted as to inhibit even and uniform spreading.
 - .2 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

- .2 Do not dispose of unused materials where it will pose health or environmental hazard.

Part 2 Products

2.1 MULCH

- .1 Straw in an unprocessed form such as in bales or rolls, free of noxious weeds, as defined by the Weed Control Act and other undesirable species such as those having ecological or maintenance concerns, e.g. Purple Loosestrife and Sweet Clover.
- .2 Material in processed form shall be shredded straw or wood fibre packaged in plastic bags.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 MULCH TACKIFIER

- .1 Water diluted liquid dispersion containing polyvinyl acetate polymer emulsion.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.
- .2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Departmental Representative.

3.2 PREPARATION OF SURFACES

- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Grade areas to be mulched.
- .3 Remove deleterious materials such as sticks, roots, or stones and loosen top 50 mm of soil to remove hardened or crusted soil.
- .4 Water soil to moisten.
- .5 Obtain Departmental Representative's approval of grade before starting to mulch.

3.3 DRY MULCHING

- .1 Mulch shall be spread by hand or mulch blower evenly and uniformly over the designated areas at a rate of 4500 kg/ha +/- 10%. Rough grade and steep slopes require more mulch and tackifier than finished or flatter ground. Adjust application rate to ensure the soil is covered with an appropriate thickness of mulch.
- .2 Tackifier shall be applied immediately after the mulch application as an aqueous slurry. The spray shall be broadcast upwards over the previously placed mulch at low pressures

to assure large droplet sizing. The tackifier shall not be applied during or immediately before a rain event.

- .3 Where tackifier is not used, mulch shall be mechanically incorporated into the soil surface of all mulched areas, using a mulch crimper, “sheep’s foot” roller, punch roller or by scarification with a track walking vehicle. Scarifications shall be parallel to the contour of the slope.

3.4 MAINTENANCE DURING ESTABLISHED PERIOD

- .1 Perform the following maintenance operations from time of application to acceptance:
 - .1 Bare spots to be re-mulched to maintain adequate cover.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 To complete planting of trees and shrubs as shown, specified, or required, and summarized, but not restricted to:
 - .1 Supply and placement of planting soil mix.
 - .2 Supply and planting of trees and shrubs, and ground cover, complete with all related components and accessories.
 - .3 Maintenance and warranty.

1.2 RELATED WORK

- .1 Section 01 35 43 Environmental Procedures
- .2 Section 32 91 21 Topsoil and Finish Grading

1.3 REFERENCE STANDARDS

- .1 Perform planting of trees, shrubs and ground covers work in accordance with the Canadian Nursery Trades Association Canadian Standards (CNTA) for Nursery Stock – latest edition except where specified otherwise.

1.4 SUBMITTALS

- .1 Submit source(s) of plant material at least 8 weeks prior to Work beginning.

1.5 DELIVERY, STORAGE & PROTECTION

- .1 Protect plant material from damage during transportation.

1.6 WARRANTY

- .1 The Contractor hereby warrants that transplanted tree will be maintained to remain healthy and free of defects for **1 year** from date of Substantial Performance.

Part 2 Products

2.1 PLANT MATERIAL

- .1 Type of root preparation, sizing, grading and quality: comply with Canadian Nursery Trades Association Canadian Standards for Nursery Stock – latest edition.
- .2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .3 Plant material: root pruned regularly.
- .4 Plant material: shall be sourced from the island of Newfoundland. Off-island supply must be approved by Departmental Representative.
- .5 Trees: to CNTA Standards, with straight trunks, well and characteristically branched for species except where specified otherwise.

- .6 Bare root stock: not acceptable.
- .7 Collected (native) stock: not acceptable.
- .8 Substitutions to plant material indicated on planting plan is not permitted unless written permission has been obtained as to size, type, variety, and quantity. Substitutions must be of similar species as originally specified.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 FERTILIZER

- .1 Commercial type, as determined by soil sample test. Organic product acceptable substitute, provided it will supply the nutrient requirements determined by soil sample test.

2.4 ANTI-DESICCANT

- .1 Wax-like emulsion to approval of Departmental Representative.

Part 3 Execution

3.1 PRE-PLANTING OPERATIONS

- .1 Ensure plant material acceptable to Departmental Representative.
- .2 Remove damaged roots and branches from plant material.
- .3 Ensure nursery applies anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Ensure Subgrade for planting areas meets requirements as outlined in this specification, and is approved by Departmental Representative.
- .2 Preparation of planting areas is specified in Section 32 91 21 – Topsoil and Finish Grading.
- .3 For individual planting holes:
 - .1 Stake out location of planting areas and obtain approval from Departmental Representative prior to excavating.
 - .2 Excavate to depth and width indicated.
 - .3 Scarify sides of planting hole.
 - .4 Remove water which enters excavations prior to planting.

3.3 PLANTING

- .1 For container stock or root balls in non-degradable wrapping, water plants before removing container. Remove container or wrapping without damaging root ball.
- .2 Plant vertically in locations as indicated.

- .3 For trees and shrubs:
 - .1 Excavate plant pit in reinstated organic stripping material. Place plant in pit and backfill with planting soil. Water to eliminate air pockets. After water has penetrated into soil, backfill to finish grade.
 - .4 Water plant material thoroughly after planting operations are complete. After soil settlement has occurred, fill with soil to finish grade.
 - .5 Dispose of burlap, wire, and container material off site.

3.4 TREE SUPPORTS

- .1 No tree supports are required.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Establishment Period: Time between planting of material and acceptance by Departmental Representative that planting has been completed and plant material is alive and healthy.
- .2 Perform following maintenance operations from time of planting to preliminary acceptance at substantial completion review by Departmental Representative.
 - .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
 - .2 For evergreen plant material: water thoroughly in late fall prior to freeze-up to saturate soil around root system.
 - .3 Remove dead or broken branches from plant material.
 - .4 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.6 PRELIMINARY ACCEPTANCE

- .1 Plant material to be inspected by Departmental Representative at completion of planting activities. Plant material shall be accepted provided that plant material exhibits healthy growing condition and is free from disease, insects and fungal organisms.
- .2 Plant material installed in Fall will be accepted in following spring, one month after start of growing season, provided acceptance conditions outlined in 1 above, are fulfilled.
- .3 Warranty period will commence from date of Substantial Completion of full contract.

3.7 MAINTENANCE DURING WARRANTY PERIOD

- .1 Commence maintenance immediately following installation of Work and continue it until 1 year (the guarantee period) following Substantial Completion of Contract.
- .2 This maintenance will be the sole source of maintenance of the work during this period and is wholly the Contractor's responsibility.
- .3 From time of acceptance by Consultant to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

- .2 For evergreen plant material: water thoroughly in late fall prior to freeze-up to saturate soil around root system.
- .3 Remove broken or hazardous branches from plant material.
- .4 Notify Departmental Representative when maintenance period is completed to arrange final inspection and transfer of maintenance responsibility to Owner.
- .5 Replace plants deemed to be unacceptable by Departmental Representative. Extend warranty period for one year from date of replacement.
- .6 Include the cost of maintenance in the Total Tender Price in the Form of Tender.

3.8 CLEAN-UP

- .1 Remove materials which have spilled onto adjacent surfaces during Work of this Contract.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 31 05 16 – Aggregate Materials
- .4 Section 31 23 33.01 – Excavating, Trenching and Backfilling

1.2 REFERENCES

- .1 CSA International
 - .1 CSA B182.6-11, Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications
 - .2 CSA B182.8-11, Profile Polyethylene (PE) Storm Sewer Pipe and Drainage Pipe and Fittings
 - .3 CSA –G401, Corrugated Steel Pipe Products
 - .4 CSA-GA257.2, Standards for Concrete Pipe

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit list of all pipe, indicating location, type, diameter, length and invert elevations for Departmental Representative review, at least 4 weeks prior to ordering of pipe.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Samples:
 - .1 Inform Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.
- .5 Certification: to be marked on pipe.
- .6 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

- .1 Store materials in accordance with manufacturer's recommendations.
- .2 Store and protect pipes from damage.
- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- .1 High Density Polyethylene Pipe: double walled, with a smooth interior surface, conforming to CSA-B182.8. HDPE shall have a minimum stiffness of 320 Kpa.
- .2 Joints: Bell and spigot with integrated gasket.

2.2 CORRUGATED STEEL PIPE

- .1 Corrugated steel pipe: to CSA-G401, aluminized or double zinc corrugated steel pipe, couplers, nuts and bolts. Diameter as noted with 68 x 13 corrugations, or to match pipe to be extended.
- .2 Couplers to be annular corrugated with minimum width of 600 mm and extend 360 degrees around the pipe and fastened with bolts.

2.3 CONCRETE PIPE

- .1 Reinforced concrete pipe: to CSA A257.2 diameter as indicated, strength classification 65-D.
- .2 Rubber gaskets for joints: to CSA A257.
- .3 Cement mortar joint filler:
 - .1 Portland cement: to CSA A3000 type 10.
 - .2 Sand: to ASTM C144.
 - .3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

2.4 GRANULAR BEDDING AND BACKFILL

- .1 Granular bedding and backfill material to Section 32 11 23 - Aggregate Base Courses.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

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

3.3 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.4 BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of corrected maximum dry density.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.5 LAYING HDPE PIPE CULVERTS

- .1 Begin placing pipe at downstream end of culvert with flanged end of first pipe section facing upstream.
- .2 Ensure bottom of each pipe is in contact with shaped bed throughout its length.
- .3 Do not allow water to flow through pipes or excavation during construction except as permitted by Departmental Representative.
 - .1 Water control proposed by the Contractor is subject to review and approval by the Departmental Representative.

3.6 JOINTS: HDPE PIPE CULVERTS

- .1 Joints to be Type 2 silt-tight gasket joints which shall not leak when tested in accordance with ASTM D3212.

3.7 LAYING CORRUGATED STEEL PIPE CULVERTS

- .1 Begin placing pipe at downstream end.
- .2 Ensure bottom of each pipe is in contact with shaped bed throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Do not allow water to flow through pipes or excavation during construction except as permitted by Departmental Representative.
 - .1 Water control proposed by the Contractor is subject to review and approval by the Departmental Representative.

3.8 JOINTS: CORRUGATED STEEL CULVERTS

- .1 Corrugated steel pipe: joints / couplings shall be non-corroding, steel culverts aluminized Type II to manufacturer's standards.
- .2 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .1 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .2 Insert and tighten bolts.

3.9 LAYING CONCRETE PIPE CULVERTS

- .1 Begin at downstream end of culvert with flanged end of first pipe section facing upstream.
- .2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.
- .3 Do not allow water to flow through pipes or excavation during construction except as permitted by Departmental Representative.
 - .1 Water control proposed by the Contractor is subject to review and approval by the Departmental Representative.

3.10 JOINTS: CONCRETE PIPE CULVERTS

- .1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar.
 - .1 Rubber gasket joints:
 - .1 Install in accordance with manufacturer's written recommendations.
 - .2 Ensure that tapered ends are fully entered into flanged ends.
 - .2 Bituminous filled joint:
 - .1 Make joint with excess of filler to form continuous bead around outside of pipe and finish smooth on inside.
 - .3 Mortar joints:
 - .1 Prepare mortar as specified herein.
 - .2 Clean pipe ends and wet with water before joint is made.
 - .3 Place mortar in lower half of flanged end of pipe section in place.
 - .4 Apply mortar to upper half of tapered end of pipe section being installed.

- .5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.
- .6 Clean inside of pipe and annular space between ends of pipes after each joint is made.
- .7 Fill joint with mortar and finish smooth and even.
- .8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.
- .9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

3.11 BACKFILLING

- .1 Place and compact granular material for bedding and backfilling in accordance with Section 31 23 33.01 – Excavating Trenching and Backfilling.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 – Construction / Demolition Waste Management and Disposal
- .2 Section 32 11 16.01 – Granular Sub-base.

1.2 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M180-2011, Corrugated Sheet Steel Beams for Highway Guardrails.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A307-12, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .4 Canadian Standards Association (CSA)
 - .1 CAN/CSA-080 Series-08 (R2012), Wood Preservation
 - .2 CAN/CSA-S136, Cold Formed Steel Structure Members
 - .3 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles
- .5 Newfoundland and Labrador Department of Transportation and Works (NLDTW)
 - .1 NLDTW Specification Book

1.3 DEFINITIONS

- .1 Steel W-Beam Guide Rail shall consist of single W-beam guide rail with posts spaced at 3.81 m intervals and off-set blocks at each post.
- .2 Steel W-Beam Guide Rail – Bridge Approach shall consist of single W-beam guide rail between posts spaced at 1.905 m intervals except for the first length of rail extending from the end of the bridge which shall have posts spaced at 0.953 m intervals. All posts to have off-set blocks at each post.

1.4 SAMPLES

- .1 At least 4 weeks prior to commencing work, inform Departmental Representative of proposed sources of guide rail and components, and provide access for sampling.

Part 2 Products

2.1 MATERIALS

- .1 Steel W-beam guide rail:

- .1 Steel rail and terminal sections: to AASHTO M180, Class B (3.5 mm thick), Type 2 zinc coated.
- .2 Bolts, nuts and washers: to ASTM A307, hot dip galvanized to CSA G164.
- .2 Timber post and offset block:
 - .1 Well seasoned, straight and sound, free from loose knots or other defects, dressed four sides.
 - .2 Sizes: posts to be 200 mm x 200 mm x 2.1 m in length; blocks to be 200 mm x 200 mm x 440 mm in length.
 - .3 Acceptable species of wood: Jack Pine or Eastern Hemlock.
 - .4 Treat posts and blocks to CSA 080 commodity standard 080.14-M, pressure preserved wood for highway construction Table 1 and its references. Standard minimum retention of CCA preservative 6.4 kg/m³.
 - .5 Reflector strips shall be 70 mm x 75 mm on metal backing.
- .3 Fasteners:
 - .1 Spikes: to CSA B111 with spiral shank. Spikes to be hot dip galvanized after manufacture with 40 g minimum weight of zinc coating, to CSA G164.

Part 3 Execution

3.1 ERECTION

- .1 Install posts and rails in accordance to contract drawings or directed by the Departmental Representative.
 - .1 Bury end treatment in accordance to contract drawings.
- .2 Install posts plumb at locations and with minimum embedment of 1320 mm in road embankment or directed by Departmental Representative.
- .3 Excavation of post holes shall be by auger with diameter of hole to be approximately 360 mm. Trench excavation is not permitted.
- .4 Bottom of each post hole to be compacted to provide firm foundation. Set post plumb and square in hole, backfill in 150 mm layers and compact each layer before placing succeeding layer.
- .5 Cutting of posts is not permitted without approval of the Departmental Representative.
- .6 Treat cut with two coats of same type of wood preservative used to pressure treat posts.
- .7 Connect off-set blocks to posts with 2-100 mm spikes.
- .8 Erect steel W-beam components to details indicated. Lap joints in direction of traffic. Tighten nuts to 100 N.m. torque. Maximum protrusion of bolt 6 mm beyond nut.
- .9 Once the W-beam rail is properly installed, new reflective strips shall be placed immediately on every second post and on each end post.
 - .1 White reflector shall be placed facing the approaching traffic in the immediately adjacent driving lane and yellow reflector on the opposite side of the same post facing traffic in the other direction.

3.2 TOUCH-UP

- .1 Clean damaged surfaces with brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas in accordance with manufacturer's instructions.

3.3 REMOVAL

- .1 Wooden posts and steel guide rail systems shall be removed where and as directed by the Departmental Representative.
- .2 Components which are considered salvageable by the Departmental Representative shall be removed with care, delivered and stacked in neat piles at a location to be designated by the Departmental Representative;
 - .1 Every effort shall be made to avoid damage to reusable guide rail system components during the removal operation.
 - .2 The use of heat to remove bolts and the cutting of rail sections and bolts shall be not permitted unless approved by the Departmental Representative.
 - .3 For Parks Canada depot locations, Contractor must provide 48 hour notice to Parks Canada staff to arrange drop off.
- .3 Remaining non-salvageable components shall be removed and disposed of in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal.
- .4 Post holes to be backfilled and compacted with Sub-Base Granular material.
- .5 Area to be graded to match surrounding shoulder elevation.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section details the requirements for the fabrication and erection of metal railings for structures, including posts, anchors, fasteners and ancillaries.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 30 51 – Concrete for Bridge Decks
- .4 Section 05 12 33 – Structural Steel for Bridges
- .5 Section 05 50 00 – Metal Fabrications

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A307, Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
 - .2 ASTM A325, Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .3 ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .3 Canadian Standards Association (CSA)
 - .1 CSA G40.20/G40.21 13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92 (2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).
 - .4 CAN/CSA S16-14, Design of Steel Structures.
 - .5 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
 - .7 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).

1.4 SUBMISSIONS AND DESIGN REQUIREMENTS

- .1 One month prior to the start of fabrication, submit to the Departmental Representative the following information in respect to the Fabricator:
 - .1 Verification of CSA W47.1 certification.
 - .2 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.

- .3 General outline of schedule for fabrication.
- .4 Material test reports for all materials.
- .5 Valid Canadian Welding Bureau certification for each welder and welding operator for the positions and processes intended.
- .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Shop drawing review by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of work.
- .4 Each drawing submitted to bear signature and stamp of qualified professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.
- .5 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners and welds. Indicate welds by CSA W59 welding symbols.
- .6 The Contractor shall submit four complete sets of shop drawings showing full details and erection/assembly of all components of the railings to the Departmental Representative for approval at least two weeks prior to commencing fabrication.
- .7 Test Reports: submit fabricator's certified quality control test reports showing compliance with approved shop drawings, specified performance characteristics and physical properties.

Part 2 Products

2.1 METAL TRAFFIC BARRIER

- .1 Materials shall be according to the barrier specified on the Contract Documents. Modification of the barrier material shall not be made without the written permission of the Departmental Representative.

2.2 BARRIER WALL RAILING

- .1 TL-4 Steel Barrier:
 - .1 Steel, unless otherwise approved, shall be according to CSA G40.21.
 - .2 Posts and plates shall be Grade 350 W.
 - .3 HSS rails shall be ASTM A500, Grade C.
- .2 Welding materials: to CSA W59.
- .3 Welding electrodes: to CSA W48 Series.
- .4 High strength Type 1 bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M upon approval by Departmental Representative. Bolt assemblies to be galvanized.

- .5 Anchor bolts: to ASTM A307 or better.
- .6 Stud shear connectors: to CSA W59, Clause 5.5.6 and Appendix H, or better.
- .7 All steel surfaces shall be protected by hot dipped galvanizing. Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m².

2.3 ANCHORAGE ASSEMBLY

- .1 Anchor bolts and anchorage plates shall be as specified on the Contract Documents. The anchorage shall be hot dipped galvanized according to CSA G164. The anchorage assembly shall be supplied with the bolts installed in a template.

2.4 GROUT

- .1 Grout shall be non-staining, non-shrink cement based grout or non-staining, non-shrink epoxy based grout as specified in the Contract, or as approved by the Departmental Representative.

2.5 ZINC-RICH COATING

- .1 Zinc-rich coating shall be according to CAN/CGSB 1.181.

Part 3 Execution

3.1 GENERAL

- .1 Railing components shall be protected from damage and distortion during handling, transportation, storage and installation.
- .2 When bedding grout is placed under post bases to obtain the proper grade and alignment, the grout shall have a minimum thickness of 5 mm and a maximum thickness of 15 mm. The mixing, surface preparation, installation and curing shall be according to the manufacturer's written instructions. A rubber pad as indicated on the Contract Drawings shall also be provided beneath each barrier post.
- .3 The work shall include installation of the anchorage assemblies.

3.2 ALIGNMENT

- .1 The railing shall be installed to the elevations and alignment shown on the Contract Drawings and approved shop drawings with a tolerance of ± 6 mm and with no kinks or other visible breaks in alignment throughout the length of the installation.
- .2 After construction is complete, barrier posts to be plumb in transverse direction of bridge and perpendicular to deck/curbs in longitudinal direction.

3.3 ANCHORAGES

- .1 General: Anchorages shall be accurately and securely located.
- .2 Anchorages Installed Before Concrete Placement:
 - .1 Anchorage assemblies as shown on the Contract Drawings shall be used to secure the bridge railing posts to the concrete. Components shall be installed prior to

placing concrete and shall be securely tied to reinforcing steel. Anchorage assemblies shall be positioned with templates and installed securely in the formwork to maintain the position of the anchors during placement of concrete.

- .2 Hi-tensile bolts (above concrete) and plate washers shall be given a heavy coating of white non-staining grease.
- .3 Properly sized and detailed plate washers are required to safely transfer anchor tension loads across the slotted hole in the barrier post base plate. Plate washers for barrier posts anchorages are to be fabricated as per the details provided on the Contract Drawings.
- .4 Ensure that adequate thread extension is detailed for the anchor bolt assemblies such that the base plate, plate washer and nut can be fully installed at each barrier post location. The anchor bolt nuts shall be capable of being fully threaded onto the anchor bolts.

3.4 FABRICATION OF RAILINGS

- .1 General:
 - .1 The railing system components shall be fabricated according to the details specified. Field modification shall only be done when approved by the Departmental Representative.
 - .2 When welding is required, the fabricator shall be certified according to CSA W47.1 for steel railings.
- .2 Steel Components:
 - .1 Unless otherwise specified in the contract, fabrication and welding shall be according to Section 05 12 33 – Structural Steel for Bridges.
 - .2 All flame cut edges shall be as smooth and regular as those produced by edge planing and shall be free of slag.
 - .3 When galvanized surface is damaged, the exposed steel shall be immediately cleaned of all rust, oil and grease and coated with a 75 µm maximum thickness of zinc-rich paint. After erection, the surface shall be given a second coating of zinc-rich paint of the same thickness.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Measurement procedures.
- .2 Waste management and disposal.
- .3 Materials.
- .4 Installation.
- .5 Removal and salvage.
- .6 Cleaning.

1.2 RELATED SECTIONS

- .1 Section 01 35 00 – Traffic Regulation
- .2 Section 01 35 43 – Environmental Procedures

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A276-91a, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - .2 ASTM B209M-92a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .3 ASTM B210M-92a, Specification for Aluminum-Alloy Drawn Seamless Tubes.
 - .4 ASTM B211M-92a, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB1-GP-12c-65, Standard Paint Colours:
 - .2 CAN/CGSB-1.28-M89, Alkyd, Exterior House Paint.
 - .3 CAN/CGSB-1.59-M89, Alkyd, Exterior Gloss Enamel.
 - .4 CAN/CGSB-1.94-M89, Xylene Thinner (Xylol)
 - .5 CAN/CGSB-1.99-92, Exterior and Marine Phenolic Resin Varnish.
 - .6 CAN/CGSB-1.104-M91, Semigloss Alkyd Air Drying and Baking Enamel.
 - .7 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
 - .8 CGSB 1-GP-189M-78, Primer, Alkyd, Wood, Exterior.
 - .9 CGSB 31-GP-3M-88, Corrosion Preventative Compound, Cold Application, Soft Film.
 - .10 CGSB 62-GP-9M-80, Prefabricated Markings, Positioning, Exterior, for Aircraft Ground Equipment and Facilities.
 - .11 CGSB 62-GP-11M-78, Marking Materials, Retroreflective, Enclosed Lens, Adhesive Backing.
- .3 Canadian Standards Association (CSA)

- .1 CAN/CSA-G40.21-M92, Structural Quality Steels.
 - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-080 Series-M89, Wood Preservation.
 - .4 CSA 0121-M1978, Douglas Fir Plywood.
 - .5 CSA W47.2-M1987, Certification of Companies for Fusion Welding of Aluminum.CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped
- .4 Newfoundland and Labrador Department of Transportation and Works (NLDTW)
- .1 NLDTW Specification Book

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Divert unused metal and/or plastic materials to recycling facility approved by Departmental Representative.
- .3 Damaged signs and posts from any removals to be transported to recycling facility approved by the Departmental Representative.

Part 2 Products

2.1 SIGNS

- .1 Signs as indicated on the drawings.

2.2 MATERIALS

- .1 All materials shall be in accordance with NLDTW Specification Book and Parks Canada Specifications.

Part 3 Execution

3.1 INSTALLATION

- .1 The Contractor shall load, haul and install posts and existing signs (see detail sheet for typical sign) and bases in the following manner:
 - .1 The Contractor is responsible for locating power/telephone/gas lines/services/utilities at all proposed sign locations.
 - .2 The Contractor is responsible for layout and measurements to ensure signs are installed as per drawings and as directed by the Departmental Representative.
 - .3 Sign bases: Excavate hole for the post at the location and depth provided by the Departmental Representative. Using some of the excavated materials, level and compact bottom of hole. Place post with one side parallel to the edge of asphalt and level.
 - .4 Adjust the post height by using a cut off saw. All post cuts will be determined in the field by the Departmental Representative. The Departmental Representative

will measure existing elevations at each site and calculate the cuts needed. The Contractor is required to provide the Departmental Representative with a minimum of 48 hours notice in order to perform the calculations.

- .5 Assemble the signs on the forks on the ground. Slide forks onto posts and place the cap.
- .6 Drill 1 hole in the base sleeves and posts for ½” bolts, as shown in the detail sheet and as verified by the Departmental Representative, and shim to plumb if necessary.
- .7 Bases must be perfectly plumbed. Vertical and horizontal tolerances for the base are 0.075m. Tolerance for the plumb of the posts is 0.01 m per 1.0 m or ¼” on a two foot carpenters level. Tolerances for the signs are 0.075 m for distance from asphalt and 0.075 m for height above white line.
- .8 The Contractor is responsible for hauling all materials to and from each work site.
- .9 Landscape so the top of the base is flush or 25 mm above finished grade.
- .10 Remove all excess material on site including, boulders larger than 100 mm.
- .11 All signs are to be covered until the Departmental Representative advises to uncover.
- .12 Payment for this item shall be based on the number of signs installed and shall include all material, labour and equipment required to satisfactorily complete this item of work.

3.2 CLEANING

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

END OF SECTION

APPENDIX A
Environmental Documents



Parks
Canada

Parcs
Canada

Parks Canada National Best Management Practices Roadway, Highway, Parkway and Related Infrastructure

Canada



Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure

Approved by

Original signed by Mike Wong

Mike Wong, Executive Director Natural Resource Conservation Branch

Original signed by Calvin Mercer

Calvin Mercer, Associate Vice-President Asset Management and Project Delivery

July 23, 2015

Date



Contents

Introduction	4
Scope of Application	4
Exceptions	6
Approved geographic area of application	7
Components of the environment that may be affected	7
Mitigation Measures	7
1. Project Design	9
2. General Activities Mitigations Module	9
3. Asphalt Production and Handling Mitigations Module	11
4. Concrete Handling Mitigations Module	13
5. Paving, Resurfacing, Grading Mitigations Module	15
6. Barriers and Guardrails Mitigations Module	16
7. Vegetation Removal Mitigations Module	16
8. Excavations, Soil Stripping and Overburden Removal Mitigations Module	19
9. Slope Stabilization, Drilling and Blasting Mitigations Module	20
10. Soil and Vegetation Restoration Mitigations Module	23
11. Drainage Structures Mitigations Module	27
12. Bridge Maintenance Mitigations Module	29
13. Water Withdrawal and Dewatering Mitigations Module	31
References	33
Appendix 1 Regulatory Guidance	35



Introduction

The Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure will allow an identified suite of project activities to be undertaken in such a manner that there will not be resulting significant adverse environmental effects.

The Best Management Practice (BMP) pathway is applied when there is a suite of routine, repetitive projects (e.g. paving) or activities (e.g. de-watering), with well understood and predictable effects. This fulfils Park's **Canada's obligations** under the *Canadian Environmental Assessment Act 2012* as a manager of federal land, see the [Guide to the Parks Canada EIA Process](#). The BMP maximizes efficiency through creation of a pre-approved impact assessment for the defined suite of projects, to which standard mitigation and environmental management measures can be applied.

The impact assessment officer (IAO) will review a proposed project and advise the functional manager of the project if and how this BMP should be applied. **The IAO's** advice will be based on whether the project falls within the scope of the BMP, and whether application of the mitigation measures in the BMP will adequately address potential adverse effects of the project.

Project Managers are responsible to ensure all mitigation measures applicable to the project are added to the terms and conditions of any permits or contracts issued for the project.

The Impact Assessment Officers must ensure the project, EIA pathway applied and determination are recorded in the Parks Canada National Impact Environmental Assessment [Tracking System](#).

Scope of Application

This BMP outlines the impact assessment of repetitive and routine projects on roadways, highways and parkways. If a project involves some or all of below activities, and the initial assessment of site and project **indicate "the project is unlikely to result in significant adverse environmental effects" the BMP can be applied.** Projects that this BMP would likely be applied to include:

- The proposed maintenance or repair of an **existing** sidewalk, or parking lot.
- The proposed maintenance or repair of an **existing** road, including pull-off areas, that would be carried out on the existing right of way¹.

Activities included in the scope of this BMP are:

1. Project Design
2. General Activities
 - Worksite Conditions/Staging/Laydown
 - Equipment operations
 - Fuel storage and refueling

¹ Highway Footprint or Right of Way (ROW): The permanent physical intrusion of a highway or freeway, including the road surface, shoulders, side slopes, drainage ditches and/or storm drainage ponds (Transport Canada, 2008).



- Site Clean Up/Waste Disposal
3. Asphalt Production and Handling
 - Asphalt Plant Operation
 - Gravel Crushing and Washing
 - Oiling of Truck Boxes
 - Clean Up and Disposal of Waste Products
 4. Concrete Handling
 - Operation, maintenance and inspection of Onsite Temporary Concrete Washout Facility
 - Removal of Temporary Concrete Washout Facilities
 - Onsite concrete management
 5. Paving, Resurfacing and Grading
 - Grading
 - Paving and Resurfacing
 - Pavement Marking and Barrier and Guardrail Reinstatement
 6. Barriers and Guardrails
 - Repair, replacement and upgrades of barriers and guardrails
 7. Vegetation Removal
 - Vegetation Removal
 - Grubbing
 - Brushing
 - Disposal of Vegetation Debris
 - Integrated Pest Management
 8. Excavation, Soil Stripping and Overburden Removal
 - Excavation
 - Soil Stripping
 - Topsoil Salvage
 - Excavated Material Storage
 - Excess Material and Waste (overburden removal)
 9. Slope Stabilization, Drilling and Blasting
 - Slope stabilization-scaling, hydraulic hammers
 - Drilling and blasting for Slope Stabilization and Geotechnical Investigations
 10. Soil and Vegetation Restoration
 - Topsoil Replacement
 - Soil Amendments
 - Seedbed Preparation
 - Species Selection
 - Seed Lot Selection
 - Seed Mixture Composition
 - Seeding
 - Alternatives to Seeding
 - Reclamation Standards
 - Reclamation Plot Evaluation
 - Time Limits



10. Drainage Structures
 - Drainage structures
 - Culverts
11. Bridge Maintenance
 - Bridge Cleaning
 - Bridge Repairs Using Treated Wood Products
 - Bridge and Structure Painting
12. Water Withdrawal and Dewatering
 - Water Withdrawal
 - Pump Screens
 - Dewatering

Exceptions

This BMP is not suitable for the following project activities as they would require supplemental assessment and/or mitigations:

- Work that may impact aquatic or terrestrial wildlife habitat connectivity, such as fences or culverts;
- Elongation of culverts; realigning water courses; dredging; or work below the high water mark of a fish bearing water body;
- Bridge projects needing work to occur below the High-Water Mark¹, with permanent alteration to the water course, such as replacement of piers/abutments or permanent installation of structures on the bed of a water body;
- Greater than 10% increase in land use footprint (e.g. gravel pit expansion); and,
- Work which might adversely impact any potential or established Aboriginal and Treaty rights or traditional use².

If the project has the potential to have an adverse effect on the critical habitat of a species at risk (with endangered, threatened, or extirpated status) this BMP does NOT apply. The project will require a separate environmental impact analysis.

If the project has the potential for **residual** adverse effects on a listed species at risk (including effects to individuals and residence of the individuals) this BMP does NOT apply, the project will require a separate environmental impact analysis.

Note: If there is any uncertainty regarding potential adverse effects to species at risk, consult a member of the [National Office Species Conservation team](#).

¹ High-water Mark is the usual or average level to which a body of water rises at its highest point and remains for a sufficient time so as to leave a mark on the land. (Fisheries and Oceans, 2015). Upper Controlled Water Elevation (UCWE) is used as definition of High-water Mark in managed waterways.

² Parks Canada must engage in additional and separate consultations with Aboriginal groups if there is a possibility of a project adversely affecting established or potential Aboriginal or Treaty rights. This is required to fulfill federal government responsibilities in upholding the honour of the crown. If there is uncertainty regarding the need for Aboriginal consultation with respect to a project, refer the matter to Parks Canada Legal Services for advice. Guidance on consultation may be sought from the [Aboriginal Affairs Secretariat](#) and from the guidance document "[A Handbook for Parks Canada Employees on Consultation with Aboriginal Peoples](#)".



Approved geographic area of application

This BMP is intended for use in all Parks Canada administered protected heritage places with roadways, highways and parkways.

Components of the environment that may be affected

Potential effects from projects of this type are well understood and predictable. They include:

Water Resources:

- Adverse modifications to surface drainage patterns
- Reduced water quality due to increased erosion, sedimentation, transportation of debris and contamination (i.e. from leaks and accidental spills, etc.)

Soil/Land Resources:

- Change in slopes, landforms, and landscape
- Soil compaction and rutting
- Slope instability, due to increased soil exposure and improper excavation and storage
- Soil contamination

Air quality:

- Decreased ambient air quality (i.e. from dust, equipment emissions, etc.)
- Increased ambient noise levels
- Temporary increased levels of CO₂ and other pollutants
- Temporary increased localized temperatures from paving and equipment operation.

Flora and Fauna:

- Damage to and/or removal of vegetation in immediate or adjacent areas
- Introduction of non-native species populations, or expansion of existing populations
- Wildlife sensory disturbance causing displacement/preferred habitat avoidance
- Wildlife habituation/attraction to artificial food sources
- Impeded/altered wildlife movement
- Damage to nests/disruption of nesting animals
- Mortality from project activities

Cultural Resources:

- Adverse effects on the heritage value or character-defining elements of a cultural resource
- Impacts to archaeological resources (known or potential)

Mitigation Measures

To use the document efficiently, keep the activity mitigation lists that apply to the project expanded and collapse the other activities by clicking on the section titles, print this as a pdf or



paper document and include with the EIA determination record. This will reduce the overall size and scope of the mitigations to present to contractors and project managers.

Choose all that apply to project. Each title is hyperlinked to the related section.

Module

1.	Project Design
2.	General Activities
3.	Asphalt Production and Handling
4.	Concrete Handling
5.	Paving, Resurfacing, Grading
6.	Barriers and Guardrails
7.	Vegetation Removal
8.	Excavations, Soil Stripping and Overburden Removal
9.	Slope Stabilization, Drilling and Blasting
10.	Soil and Vegetation Restoration
11.	Drainage Structures
12.	Bridge Maintenance
13.	Water Withdrawal and Dewatering



1. Project Design

When upgrades to infrastructure are planned opportunities to decrease the environmental impacts of long term operation should be considered in the engineering design. Some examples are: directing runoff into vegetated areas rather than directly into surface waters to decrease pollution in surface waters, increasing the span length of bridges during replacements to allow for terrestrial wildlife passage underneath and converting smaller culverts to larger culverts or clear span bridges to allow for better fish passage and less restricted flows.

2. General Activities Mitigations Module

Construction activities involve the use of laydown/staging areas, equipment operations, storage and handling of hazardous materials. Potential adverse effects include: destruction of vegetation, erosion and sedimentation, constriction for wildlife movements and introduction/spread of non-native vegetation.

Work Site Conditions/Staging/Laydown

- 2.1. All employees must attend a briefing with an Impact Assessment Officer (IAO) or Surveillance Officer (SO) before beginning work at the site review and explain the mitigations that are conditions of the project approvals.
- 2.2. Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible.
- 2.3. Avoid or terminate activities on site that attract or disturb wildlife. Vacate the area and stay away from the immediate location if wildlife display aggressive behaviour or persistent intrusion.
- 2.4. Control materials that might attract wildlife (e.g. petroleum products, human food and garbage).
- 2.5. Notify the SO immediately about dens, litters, nests, carcasses (road kills), wildlife activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported to SO within 24 hours.
- 2.6. Delineate the work zone; clearly mark the limits to active construction and the access and egress locations.
- 2.7. When work involves the disturbance of soils or the use of erodible materials (e.g. sands, topsoil), prevent the transport of sediment by the installing of appropriate erosion and sediment control.
- 2.8. An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken in proximity to watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger. The ponds shall also be designed to handle 1:5 year storm events, with overflow spill capacity for 1:10 year storm events and emergency spillway capacity for 1:100 year storm events. All components require regular maintenance to ensure effectiveness.

Equipment Operations

- 2.9. Equipment movements and workers' **private vehicles shall be restricted to the 'footprint'** of the construction area.



- 2.10. Ensure machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, noxious weeds and soils from off-site.
- 2.11. Operate machinery on land above the high water mark, on ice, or in another manner that minimizes disturbance to the banks and bed of any water body.
- 2.12. Limit machinery crossing (fording) a stream or watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure in compliance with the *Fisheries Act*.
- 2.13. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
- 2.14. Use temporary crossing structures or other practices to cross streams or water bodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds.

Fuel Storage and Refueling/Emergency Plans

- 2.15. A Spill Response Plan will be prepared and detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products in accordance with all applicable federal and provincial legislation. The Plan shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement and sand blasting agents.
- 2.16. Spill kits shall be provided at re-fuelling, lubrication, and repair locations that are capable of dealing with 110% of the largest potential spill and shall be maintained in good working order. Site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- 2.17. If potentially hazardous materials (e.g. cement-based products, sealants or paints) are used on site ensure raw material, mixed compounds and wash water are not released to any watercourse or soils. Measures such as collection/drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks can prevent spills into the environment.
- 2.18. Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways.
- 2.19. Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The SO shall be notified immediately of any spill. In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up.
- 2.20. The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the proponent. The site will be inspected to ensure completion to the expected standard and to the satisfaction of Parks Canada.

Site Clean Up/Waste Disposal

- 2.21. Clean tools and equipment off-site to prevent the release of wash water that may contain deleterious substances.



- 2.22. Where possible, sweep up loose material or debris. Any material thought to pose a risk of contamination to soils, surface water or groundwater should be disposed of appropriately off-site.
- 2.23. Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in Parks Canada protected heritage places. These wastes shall be contained and removed in a timely and approved manner and disposed at an appropriate waste landfill site located outside the Parks Canada protected heritage place. Construction waste storage containers, shall be emptied when 90% full. Waste containers will have lids, be wildlife proof if there attractants and waste loads shall be covered while being transported.
- 2.24. Sanitary facilities, such as a portable container toilet, shall be provided and maintained in a clean condition.

3. Asphalt Production and Handling Mitigations Module

Asphalt is a common building material for transportation infrastructure. Its production requires the use of gravel, water, and petroleum products, and associated project activities include transportation, storage and handling of these materials. Installation of asphalt plants is common within the larger parks where gravel extraction is undertaken.

Timing of Works

- 3.1. Asphalt works are preferably undertaken during periods of dry weather as this allows easier control of contaminated runoff and sediment.
- 3.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

Operation of Asphalt Plants

- 3.3. Asphalt plant operation must comply with all environmental pollution control regulations, including provincial regulations, and the plant operational plan.
- 3.4. Spoil piles and stock piles will be at least 30 meters from the edge of any water body.
- 3.5. There must be enough room between the stockpiles and the asphalt plant for a loader in the event of a spill at the asphalt plant.
- 3.6. A containment berm with an associated liner made of occlusive material (e.g. plastic of a thickness approved by the SO) and covered with absorbent sand or clay shall be **installed under the asphalt storage tank to ensure containment of 110% of the tank's capacity.**
- 3.7. The proponent shall be responsible for the purchase and safe delivery/storage/handling of asphalt cement and emulsions to the asphalt plant site.
- 3.8. Excess hot mix or reject new asphalt shall be temporarily in stored in the containment area sufficient to prevent runoff of petroleum into soils or surface waters as directed by the SO, and removed from the Parks Canada protected heritage place, prior to project completion.



- 3.9. Every effort will be made to recycle waste asphalt, either as a base course, or by recycling waste asphalt through the asphalt plant according to engineering specifications. Old cured ground asphalt material shall be removed, recycled, or stored for future recycling at an approved operational gravel pit or asphalt plant site. Stockpiles must be further than 30 metres from any surface waters.
- 3.10. Remaining stockpiles will be removed or incorporated into reclamation plans for the gravel pits or asphalt plant sites.
- 3.11. Asphalt to be removed must be sampled and analyzed to determine possible lead contamination. Contaminated asphalt will be transported to an approved waste disposal facility. A receipt of delivery is to be provided to the SO.
- 3.12. Proponent should protect containment/catchment areas and drip trays at the asphalt plant from rainfall since, if contaminated, all of the collected water will require disposal of at an approved disposal facility at the expense of the Proponent.
- 3.13. Dyking and ponding will be required to control the rate and quality of runoff from the plant site.
- 3.14. Ensure that the water in the settling ponds remains clean of petroleum products. Any contaminated water will require disposal at an approved disposal facility at the expense of the Proponent.

Gravel Crushing and Washing

- 3.15. Where possible within engineering constraints, asphalt materials should be recycled to reduce the need for new gravel.
- 3.16. Gravel will be obtained from an approved operational borrow pit only. For gravel obtained from a borrow pit within a protected heritage place or borrow pit, gravel extraction within the footprint of the disturbed area of the approved operational borrow pit is permitted.
- 3.17. Gravel will not be crushed within 30 meters of any water body.
- 3.18. If water for cleaning is extracted from a watercourse, refer to [water withdrawal section](#) of this BMP.
- 3.19. If gravel requires washing, the water used will not be returned directly to any watercourse.
- 3.20. Water free from chemical contaminants will be discharged into ground where further erosion and runoff into surface water is prevented. Discharging into well vegetated ground surface, at a rate which prevents erosion can often provide increased absorption and reduction of sediment load.
- 3.21. Contaminated water must be treated to meet CCME guidelines or transported outside of the Parks Canada protected heritage place for disposal at an approved facility.
- 3.22. For waste removed from the park a detailed receipt of delivery to an approved facility will be provided to the SO.

Oiling of Truck Boxes

Trucks for hauling asphalt mixture shall have tight, clean, smooth metal beds that have been sprayed with a minimum amount of thin fuel oil to prevent the mixture from adhering and causing waste asphalt.

- 3.23. Truck boxes may be oiled only when absolutely necessary.



- 3.24. Oiling will take place in a bermed area, consisting of a plastic underlay with 15 centimetres overlay of clean gravel. Oil contaminated gravel will be hand collected (so as to prevent tearing of the plastic) from the bermed area daily, and put through the asphalt plant.
- 3.25. Vehicle covers shall be securely fastened.

Air Quality Mitigations

- 3.26. Asphalt plants should be 500 meters from buildings with human habitation.
- 3.27. Emissions from the asphalt plant and paving project equipment will comply with End Product Specifications (EPS) emission control standards and other provincial emissions regulations. Stack test results provided to the ESO by the operator or surveillance contractor may be required when the asphalt plant is at full capacity to ensure the plant is operating within the required standards. If the plant is not operating within the appropriate levels, production will cease until the requirements are met.
- 3.28. Sludge removed from the clarifier that is free of chemical contamination will be contained to prevent fine dust particles from becoming airborne during windy periods.
- 3.29. Unannounced stack tests will be conducted throughout the project. If the plant does not meet requirements, operation will cease until the requirements can be met.

Disposal and Clean Up of Other Waste Products

- 3.30. To ensure regular clean-up of waste asphalt and petroleum spills, a defined clean up schedule will be established during the preconstruction meeting.
- 3.31. Leaks will be collected in drip-trays, the collected material will either be removed from the park, or recycled back through the Asphalt Plant. For any material removed outside the park to an approved facility, a detailed receipt will be provided to the ESO.
- 3.32. Used oil, filters, grease cartridges, oil cans and other waste products of plant servicing will be collected and disposed of at the nearest industrial waste facility.

4. Concrete Handling Mitigations Module

Concrete is a common construction material used in transportation infrastructure. Its use ensures longevity of the infrastructure and safety for public use. One litre of concrete wash water or leachate in 1000L of water will kill fish. Cement-based products including grouts and concrete are lethal to fish and many other aquatic organisms. Raw product or leachate entering a watercourse will alter water chemistry, making it more basic or alkaline.

Onsite Temporary Concrete Washout Facility

- 4.1. Temporary concrete washout facilities shall be located a minimum of 30m from storm drain inlets, open drainage facilities, and watercourses.
- 4.2. Temporary concrete washout facilities shall be temporary pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- 4.3. Straw bales, wood stakes, and sandbag materials can be used to construct temporary **containment walls or “barriers”**.



- 4.4. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
- 4.5. The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
- 4.6. Perform washout of concrete mixer trucks in designated areas only.
- 4.7. Wash concrete from mixer truck chutes into approved concrete washout facility or collect in an impermeable bag for disposal.
- 4.8. Pump excess concrete in concrete pump bin back into concrete mixer truck.
- 4.9. Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.
- 4.10. Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per federal and provincial regulations.

Maintenance and Inspection of Temporary Concrete Washout Facilities

- 4.11. Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities.
- 4.12. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
- 4.13. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- 4.14. Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).
- 4.15. Onsite concrete waste storage and disposal procedures should be monitored at least weekly or as directed by the ESO.

Removal of Temporary Concrete Washout Facilities

- 4.16. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

Onsite Concrete Management

- 4.17. Rolling concrete mixers with surplus concrete in amounts less than one cubic metre of wet concrete may waste this concrete in the grade right-of-way as directed by the Parks Canada Representative in areas that drain well away from watercourses. Surplus amounts in excess of one cubic metre are to be returned to the batching yard.
- 4.18. Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.
- 4.19. The concrete batching plant must be operated pursuant to applicable dust, air emission, and water quality control regulations.



- 4.20. Waste, solidified concrete from rolling concrete mixers in amounts less than 1 cubic meter and waste solidified concrete from construction pour shall be buried in the grade within 48 hours of the pour, subject to approval and direction from the Departmental Representative

5. Paving, Resurfacing, Grading Mitigations Module

Highway surface management activities are undertaken to ensure public safety on Parks Canada Agency highways by maintaining clean, level, and unbroken road surface conditions through activities such as pavement cleaning, patching, application of surface treatments, and pavement crack sealing. Grading is used to address drainage issues, vegetation encroachment, potholes and rough surfaces.

Timing of Works

- 5.1. Works are preferably undertaken during periods of dry weather (e.g., summer) as this allows easier control of contaminated runoff and sediment.
- 5.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

Grading

- 5.3. During grade construction conducted close to any watercourse, water body or wetland ensure materials are not pushed, fall or are eroded into the water or wetlands.
- 5.4. No grade building shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
- 5.5. Materials shall be placed at storage sites or on the grade without spillage outside the work limits. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
- 5.6. Retain a 30 metre vegetated buffer around water bodies or install runoff management structures.
- 5.7. If possible grade roads early in the spring before vegetation develops seed heads or late in season after vegetation has set seed and is dormant to minimize non-native vegetation propagation.
- 5.8. Ensure gravel or road bed material is free of weeds and comes from an approved operational gravel source free of other contaminants.

Paving and Resurfacing

- 5.9. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface waters.
- 5.10. Minimize application of seal coats in wet conditions. Attempt to apply only to dry surfaces and not prior to (within 24 hrs.) or during rainfall. If unforeseen rain arrives ensure runoff from recently seal coated surfaces are prevented from entering surface waters.
- 5.11. For asphalt handling and management see the [Asphalt Mitigation Module](#) of the BMP.



Pavement Marking and Barrier and Guardrail Reinstatement

- 5.12. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface water. Pavement marking shall be undertaken pursuant to standard methods applied in National Parks for control of paint products, both in transport and handling. The Contractor shall present a description of methods to be employed for transporting and controlling paint and hazardous products, application of paint, cleaning of equipment, containment and disposal of waste paint and cleaning products, etc. to the satisfaction of the Parks Canada Representative.
- 5.13. Where concrete barriers or guard rails are temporarily removed, for highway improvements, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

6. Barriers and Guardrails Mitigations Module

Repair, installation and upgrade of barriers and guardrails involves laydown/staging areas, equipment operations, minor excavation (e.g., for barrier post holes) and use of concrete. Potential adverse effects include destruction of vegetation and erosion and sedimentation.

Timing of Works

- 6.1. Where excavation is required, schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 6.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Repairs, Replacement and Upgrades

- 6.3. An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken within 100m of watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger.
- 6.4. Where use of concrete is required for guardrail post holes, Concrete Handling Mitigations apply.
- 6.5. If vegetation removal is required for barrier or guardrail works, Vegetation Removal Mitigations apply.
- 6.6. Where concrete barriers or guardrails are temporarily removed, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

7. Vegetation Removal Mitigations Module

Roadside vegetation management activities include mowing, brushing, and landscape maintenance activities undertaken to maintain clear sight lines for highway users, control noxious weeds, facilitate effective drainage, and reduce possible fire hazards. Mature timber



may need to be removed for improving road alignments, improving sight lines or replacing or repairing associated infrastructure. Grubbing (stump and root removal) may be required to prepare the ground surface for other activities.

Timing Windows

- 7.1. Vegetation clearing can negatively impact nesting birds and/or bats in spring and summer. Avoid all vegetation removal during this time. If vegetation removal is scheduled to occur within these times a qualified professional biologist/ecologist should further clarify the species presence and timing particular to the work site and any occupied bird nests, eggs, or nests of species protected under the Migratory Bird Convention Act (MBCA). See [appendix on regulatory guidance for further detail on the MBCA and SARA](#).
- 7.2. If a nest is found during the pre-work surveys, the vegetated area will be left intact with a suitable sized buffer of shrubs/trees around it until the young have fledged and left the nest. Size of buffer species dependent, to be determined in consultation with professional biologist or park ecologist.
- 7.3. Grass mowing and trimming should not occur during peak spring or fall reptile/amphibian migrations and hatching. Consult a local biologist/ecologist for site and species specific timing windows.

Vegetation Removal Mitigations

- 7.4. Vegetation removal should be limited to the minimum Clear Zone Distance¹ dependent on type and size of road and maximum height needed to meet the road safety objectives.
- 7.5. Minimize full removal and retain vegetation when possible to reduce erosion.
- 7.6. Prior to the commencement of any vegetation removal, the worksite must be surveyed for species at risk. If species at risk are found, work must be stopped until site-specific mitigations to address potential adverse effects are developed.
- 7.7. Survey vegetation for non-native species, clear vegetation areas with non-native vegetation in spring and early summer to avoid further spread and development of the non-native seed bank.
- 7.8. Clearing activities shall be avoided during nesting seasons for birds, reptiles and amphibian species in the project area.
- 7.9. If wildlife is observed during work, if possible, give animals the opportunity to escape the work area to the surrounding forest or elsewhere to seek new shelter.
- 7.10. Avoid ground vegetation removal during dry, windy periods to prevent erosion of topsoil and reduction of air quality with dirt/dust.
- 7.11. Retain 30 metre vegetated buffer around water bodies, where disturbance is necessary and unavoidable restoration is required.
- 7.12. Debris will not be deposited in water bodies.
- 7.13. Ensure tree limbs/stumps are flush cut as close to the ground or stem as possible.

¹ A clear zone is an unobstructed, traversable roadside area designed to enable a driver to stop safely or regain control of a vehicle that has accidentally left the roadway. The selection and design of appropriate clear zone dimensions is project-specific and should be the responsibility of professionals trained in roadside design.



- 7.14. Logs and other salvage materials are to be conveyed to and placed at a storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.
- 7.15. During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport to a designated pit.
- 7.16. Where possible preserve identified wildlife trees by limbing or topping if they are not assessed as hazard trees.

Disposal of Vegetation Debris

- 7.17. All vegetation debris must be removed as soon as possible from the right-of-way, either by transporting off-site for disposal or piling and burning on-site.
- 7.18. All vegetation containing non-native species will be piled and burnt or bagged and removed off site to disposal facility.
- 7.19. Piles will be made where trees are felled, piles will be 1.2-1.8 (4 to 6 feet) in diameter and no more than 1.2 m (4 feet) high (approximately 1 to 3 trees per pile) or as instructed by local fire and vegetation specialists.
- 7.20. Piles are to be located so that they do not scorch surrounding live trees and measures must be in place to ensure that fires do not spread (i.e., conduct burning on snow or on mineral soil).
- 7.21. Piles will be left until fall for burning to allow for curing of green fuels.
- 7.22. Provincial regulations for air quality must be met.
- 7.23. Where fire fuel loading is not a concern vegetation debris of limited amounts will be dragged in the forest to mimic natural tree fall.
- 7.24. If removal or burning are not feasible a chipper may be used for less than 50 boles per hectare. Chip depth is to be a maximum of 5 cm (2 inches), spread over area no greater of 5m x 5m per hectare so as to not cover underlying vegetation, prevent new native seedlings from sprouting, and cause soil/seed bank sterilization. Spreading of chips may extend beyond these parameters with permission from Parks Canada.
- 7.25. To facilitate chipping of woody debris, all trees/shrubs/vines can be left temporarily along the road shoulders and laid facing the same direction.
- 7.26. In some cases, logs from newly cut trees may be set aside for use elsewhere as directed by local park site managers and the ESO.
- 7.27. Store removed vegetation on already disturbed areas to minimize disturbance area.
- 7.28. In appropriate areas re-establish native vegetation where it has been completely removed/damaged.

Integrated Pest Management

- 7.29. A Field Unit Integrated Pest Management Plan (IPMP) must be completed and approved prior to the use of herbicides to ensure the most effective and least harmful substances are properly used.



8. Excavations, Soil Stripping and Overburden Removal

Mitigations Module

Construction projects often involve excavations. To successfully complete reclamation of disturbed areas, and protect areas from erosion proper soil handling and backfilling procedures must be followed. Post excavation and stripping soil and vegetation restoration mitigations should be applied. See section of this BMP for [Soil and Vegetation Restoration](#).

Timing of Works

- 8.1. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 8.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Excavation

- 8.3. Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation.
- 8.4. All sediment control measures must be in place before starting work in the vicinity of rivers, water bodies, watercourses, and wetlands.
- 8.5. Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.
- 8.6. Excavation plans must be compared to local archaeological resource inventories, if available. If no archaeological information is available for the work area, an Archaeological Overview Assessment (AOA) may be required to determine the archaeological potential of the work area. Based on the results from the AOA, an Archaeological Impact Assessment might be required. It would be time and cost efficient to refer the plan to **Parks Canada's** Terrestrial Archaeology section before conducting any excavation to determine the appropriate course of action.
- 8.7. If cultural resources (eg. archaeological resources) are discovered, immediately cease work, and alert SO.
- 8.8. Minimize changes to the ground surface that affects its infiltration and runoff characteristics and maintain/re-establish effective surface drainage on completion of the project
- 8.9. Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.
- 8.10. All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment.

Soil Stripping

- 8.11. Strip topsoil under dry conditions, whenever possible.
- 8.12. No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.



- 8.13. In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavourable for construction, heavy rain events, construction delays, etc.) erosion control of bared soils or excavated material stockpiles is required.
- 8.14. Stripping close to any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands.
- 8.15. Work within a 100 metre buffer from the high water mark of waterways or wetlands will require a site specific sediment and erosion control plan.
- 8.16. An erosion control plan is also needed to control dust generated from the construction site.

Topsoil Salvage

- 8.17. Salvage topsoil at all excavation sites for reclamation purposes.
- 8.18. Usually the upper 15 cm of soil, below the sod layer if present, is considered topsoil, where depths exceed 15cm salvage the entire depth of topsoil.
- 8.19. Remove stumps and woody debris from topsoil, wherever possible.

Excavated Material Storage

- 8.20. Allow space for separate storage of topsoil and spoil; where space is available separate stored topsoil from spoil by at least 1 m. Use appropriate material (e.g., geo-textile) to separate soil components where space is limited.
- 8.21. Topsoil may be stored on hardened surfaces, geo-textile material or directly on undisturbed vegetation. If storage occurs on vegetation, material recovery by hand may be required.
- 8.22. Cover all stockpiled material with heavy-duty plastic or filter cloth to prevent erosion during precipitation events.
- 8.23. Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain.
- 8.24. Construct barricades to prevent losses on steep terrain (>18°, 3:1) and within 100m of watercourses.

Excess Materials and Waste (Overburden Removal)

- 8.25. Remove excess excavated material from site where it cannot be used for the final grading of the area. Site specific arrangements must be made for disposal locations and procedures of overburden.
- 8.26. Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO.

9. Slope Stabilization, Drilling and Blasting Mitigations Module

Where standard excavation is not sufficient, scaling, hydraulic hammers, drilling units or trim blasting are used to break up rock or soil for removal. Accumulations of debris in ditches reduce their effectiveness at trapping rock fall and reduce public safety. Ditches will be cleaned using a loader and back hoe. Guardrails and rock fences may be temporarily removed to permit this activity.



Timing of Works

- 9.1. Time any vegetation removal work should adhere to the Migratory Bird windows for the area.
- 9.2. Time work to reduce impact to mammals, amphibians and reptiles using rock faces during sensitive life stages such as birthing and rearing of young. This often occurs during the spring. Confirm timing windows with local wildlife ecologists.
- 9.3. Avoid ditch clearing during wet periods and wait until ditches are dry to reduce impacts to amphibians and reptiles and limit sedimentation.

Slope Stabilization-Scaling, Hydraulic Hammers

The use of hydraulic hammers attached to excavators is considered the ideal solution for rock disintegration. It avoids rock blasting where the parent rock is no longer rippable by the excavator's bucket but still has enough planes of weakness for economical operation and effective use of the hydraulic hammer. Scaling is the manual removal of loose material on rock slopes using pry bars, hydraulic press, brooms, shovels and power equipment operated by personnel using roped access to a rock face.

- 9.4. For vegetation clearing refer to the [vegetation removal mitigation module](#) of this BMP.
- 9.5. For slope-stabilization in soils, please refer to the Excavation section.
- 9.6. Survey the work site for cultural resources such as rock art (ex. pictographs, petroglyphs, etc. prior to the work commencing, establish site specific mitigations for their protection.
- 9.7. Measures shall be taken to control dust as much as possible during the removal and falling of rock materials down slope.
- 9.8. Placement of rip rap and backfill on shorelines shall be undertaken without contacting the watercourse, wetted margins and must not be below the High Water Mark.
- 9.9. If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately- sized, clean rock is used, and rock is installed at a similar slope to maintain a uniform bank.
- 9.10. Direct concentrated surface water (runoff) away from cut and fill slopes.
- 9.11. Immediately stabilize banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through [vegetation restoration](#) with native species suitable for the site-refer to [soil and vegetation restoration section of BMP](#).

Drilling and Blasting for Slope Stabilization and Geotechnical Investigations

Trim blasting is used for controlled blasts in which explosive charges are placed in predetermined pattern of holes drilled into the rock face and then detonated. Potentially unstable masses of rock can sometimes be stabilized using rock bolts and long steel rods drilled into the rock to bind it together. Drilling is a common method of investigation to obtain geotechnical reports required for engineering design.



Drilling

- 9.12. Debris from drilling will be contained (screened or settle out) so it will not cover the surrounding area or enter any water course. All debris will be removed, [see section on overburden removal](#) for further mitigations.
- 9.13. The cuttings from all drilling will be contained so they can be removed entirely from the site. If contaminated, the cuttings are to be disposed at an approved waste disposal facility.
- 9.14. Control of spoil and sediment loaded water is required on the drill site. Dyking will be required to retain the deposit on non-vegetated surfaces. If contaminated, the spoil pile must be disposed at an approved waste disposal facility.
- 9.15. During aquifer tests, the water must be piped so it does not erode any soil or any part of the ground. If the water from the tests is piped to a creek, stream, or river, the pipe is to be situated so that there is no erosion of the stream bank or bed. If any sand or similar material is discharged during the aquifer test, care must be taken that the sand does not cover any vegetation.
- 9.16. All test wells will be filled in after the testing is completed. The proponent will be responsible for rectifying any future problems associated with any of the wells or test wells.

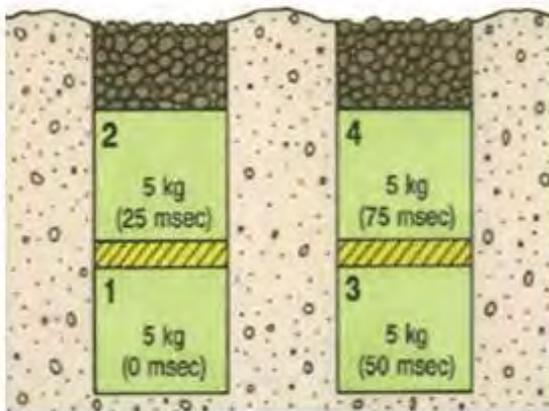
Blasting

- 9.17. The Parks Canada Representative will identify a magazine location for explosives should a factory site or "ready-to-use" explosives storage site be required
- 9.18. The blasting supervisor will ensure no damage to infrastructure, people, surrounding vegetation or wildlife by mitigating risk of fly rock.
- 9.19. Avoid using explosives in or near water. Use of explosives in or near water produces shock waves that can damage a fish swim bladder and rupture internal organs. Blasting vibrations may also kill or damage fish eggs or larvae.
- 9.20. If explosives are required as part of a project (e.g., removal of structures such as piers, pilings, footings; removal of obstructions such as beaver dams; or preparation of a river or lake bottom for installation of a structure such as a bridge or culvert), the potential for impacts to fish and fish habitat will be minimized by implementing the following measures:
 - Time in water work requiring the use of explosives to prevent disruption of vulnerable fish life stages, including eggs and larvae, by adhering to appropriate fisheries [timing windows](#).
 - Isolate the work site to exclude fish from within the blast area by using bubble/air curtains (i.e., a column of bubbled water extending from the substrate to the water surface as generated by forcing large volumes of air through a perforated pipe/hose), cofferdams or aquadams.
 - Remove any fish trapped within the isolated area and release unharmed beyond the blast area prior to initiating blasting.
 - Minimize blast charge weights used and subdivide each charge into a series of smaller charges in blast holes (i.e. Decking) with a minimum 25 millisecond (1/1000 seconds) delay between charge detonations (see Figure 1).



- Back-fill blast holes (stemmed) with sand or gravel to grade or to streambed/water interface to confine the blast.
- Place blasting mats over top of holes to minimize scattering of blast debris around the area.
- Do not use ammonium nitrate based explosives in or near water due to the production of toxic by-products. Remove all blasting debris and other associated equipment/products from the blast area.

Figure 1: Sample Blasting Arrangement



Per Fig. 1: 20 kg total weight of charge; 25 msecs delay between charges and blast holes and decking of charges within holes. (Fisheries and Oceans Canada, 2015)

10. Soil and Vegetation Restoration Mitigations Module

Almost all projects activities included in this BMP will require some ecological restoration- *the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed*. The restoration plan can be a simple application of the following mitigations and can be at the site or both at the site and in concert with another site designated to offset the permanent impact of a project. For disturbance areas greater than a hectare a restoration plan is required. The restoration works can be often be considered projects in and of themselves. Soil and vegetation restoration must apply the principles of effective, efficient and engaging solutions.

Timing Windows

- 10.1. Develop restoration plan as part of the project scoping and specifications prior to project approvals.



- 10.2. Vegetation restoration is most effective if seeded in the fall, this allows for full scarification of the seed over the winter and adequate moisture available. Spring and early summer will also work, consider using seed that requires shorter scarification times for these applications. Transplants will do best in the spring and summer and will require adequate watering.

Topsoil Replacement

- 10.3. Implement restoration plan for the disturbed area immediately following completion of construction.
- 10.4. Replace topsoil to all areas immediately following fine grading.
- 10.5. Do not compact topsoil.
- 10.6. Where insufficient topsoil is available imported soil may be used as a last resort. Imported topsoil must be certified completely free of non-native seeds and compost developed from sewage treatment plants. Methods of improving vegetation succession using locally sourced, weed and contaminant free materials are preferred.
- 10.7. Slopes to be seeded should be no steeper than 2 horizontal to 1 vertical (2:1) and covered with a minimum of 5 cm (2 inch) of topsoil. Finish grading should always follow top soil placement.
- 10.8. Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or erosion control blanket is required.
- 10.9. Methods of bioengineering such as terracing, willow staking, live pole drain systems should be assessed as solutions where soils are steeper or remain unstable.

Soil Amendments

Fertilizer Application

- 10.10. Avoid use of fertilizer to limit non-native vegetation growth and allow for local species to use available nutrients.
- 10.11. If needed use locally sourced mycorrhizae compost teas to improve vegetative success.

Topsoil substitute

- 10.12. Apply an organic cellulose only amendment as a soil substitute if reclamation standards are not being met within the defined time frame.
- 10.13. Determine the type of organic amendment based on the site-specific requirements (e.g., peat moss, compost).

Seedbed Preparation

- 10.14. The seedbed will be scarified by hand or, with the approval of the SO, by machine on large areas (i.e., roadbeds) where it is accessible and appropriate.
- 10.15. The seedbed will be scarified if seeding takes place more than 7 days after final grading or if there has been a rainfall between final grading and the seeding date.



- 10.16. The cleats of a tracked vehicle or a harrow device will be used, where possible, to prepare an adequate seedbed with seedling safe-sites (microsites) substantially free of soil crusts.
- 10.17. Align cleat marks at right angles on slopes to trap seed and sediment and reduce erosion.

Species Selection

- 10.18. When selecting species and varieties:
 - Use species of local native plant communities.
 - Species viability in proposed environment and climatic conditions.
 - Capability to effectively control erosion, where required.
 - Adaptation to the variable site conditions of undulating topography.
 - Consider palatability of some species to herbivores and avoid growing attractants in areas of increased risk to wildlife and visitors.
 - Variable life expectancy to produce variable, delayed die-out of seeded species and replacement with indigenous native plants.

Seed Lot Selection

- 10.19. Select seed lots based on indigenous species variety and quality (guaranteed weed seed free content and highest purity and germination), consult with vegetation restoration specialist or fire/vegetation ecologist.
- 10.20. Reject any seed lots containing any seed of undesirable crop or weed species.

Seed Mixture Composition

- 10.21. The proportion of each species should be calculated to provide an adequate quantity of pure live seed (PLS) per unit area of each key component.
- 10.22. Aim for density of about 140 seedlings/m² at the end of the first growing season to provide adequate ground cover and allow native species to re-colonize the site over time.
- 10.23. Consider that parameters such as seed lot purity, seed germination, seedling establishment, seed size and seeding method affect the final stand composition.

Seeding

- 10.24. Use approved native seed mixes developed for site-specific conditions for various elevations.
- 10.25. Seed and stabilize (e.g. mulch/tackifier) bare areas as soon as possible after disturbance, preferably as soon as a significant area is graded and finished and before the next rain event. If there is a risk of seedling mortality as a result of fall frost stabilize until appropriate growing conditions exist.
- 10.26. Use sod in high traffic areas or places that need extra erosion control. Source sod grown from native species (often called fescue sod) and ensure adequate anchoring and watering is in place.
- 10.27. Use temporary seeding when outside the seeding dates for permanent vegetation
- 10.28. Apply a seed mixture which is appropriate for the climate, soil, and drainage conditions of the site.
- 10.29. Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions.



- 10.30. Conduct broadcast seeding under calm wind conditions. Hydro-seeding is acceptable where access is available.
- 10.31. Do not exceed 30 kg/ha for the broadcast method, ensure seed is integrated with the soil by light rake or harrow. Broadcast method seeding rate is 25 kg/ha (2.5g/m²) (e.g., 1x25 kg bag will cover 10,000m² or 1 hectare).
- 10.32. For hydro-seeding do not exceed 75 kg/ha with light mulch rates (500 kg/ha- of mulch with hydro-seeding) and 150 kg/ha with heavy mulch rates (1500 kg/ha of mulch with hydro-seeding).
- 10.33. Do not increase the seeding rate to compensate for poor seedbed conditions.
- 10.34. Monitor temporary erosion control measures to prevent seed loss.
- 10.35. Some seeding procedures may have to be completed or repeated in subsequent years.

Alternatives to Seeding

- 10.36. Use topsoil seed bank in small areas when there is no risk of erosion or competition from invasive species (i.e., natural regeneration).
- 10.37. Use native transplants in areas where conventional seeding applications are not applicable or where slope stability is an issue.
- 10.38. Use conventional forestry planting methods for container grown transplants, see website for guidance.

Reclamation Standards

- 10.39. Minimum standard for plant density is 25 plants/m², with 90% frequency.
- 10.40. Minimum standard for plant cover is 80% ground cover, with 90% frequency.
- 10.41. Minimum standard for plant community composition standard is 50% cover and 90% frequency of native species.
- 10.42. Exclude species designated as weeds in the work sites from the plant density standard consult local vegetation ecologist for current site specific non-native vegetation management program.
- 10.43. Rock, plant litter and non-vascular species are included in the cover standard.
- 10.44. Remaining plant cover of seeded native species is acceptable.

Reclamation Plot Evaluation

- 10.45. Select any site within reclamation area measuring 10 x 10 m, providing 100 plots of 1 square meter.
- 10.46. Measure the plant density, cover and composition in each of the 100 square meter plots.
- 10.47. The reclamation standard will have been met if 90 of the 100 plots match or exceed the criteria.
- 10.48. No fertilizer will be applied one year before the reclamation standard is evaluated.

Time Limits

- 10.49. Inspect site annually during the growing season.
- 10.50. Minimum reclamation standard, as above, to be met within one season post planting.
- 10.51. Apply amendments annually, depending on reclamation progress.



- 10.52. Re-seed site if the plant density standard is not expected to be achievable within 5 years.
 - A new restoration plan will be prepared and implemented when reclamation standards have not been met after 5 years.

11. Drainage Structures Mitigations Module

Drainage structures on roadway, highway and parkways are structures such as culverts, ditches and drains. Drainage structure management activities are undertaken to ensure that surfaces are safe and efficiently drained, water is efficiently channeled to ditches and watercourses, and erosion of highways and adjacent properties is prevented. These mitigations include the cleaning and maintenance of drainage structures and related hardware, as well as the repair or replacement of existing and installation of new drainage structures.

Timing of Works

- 11.1. Time work in water to respect **timing windows** to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics specialists and DFO offices for further information on **timing windows** in your region.
- 11.2. Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- 11.3. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 11.4. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Drainage Structures

- 11.5. Isolate your work area from any flowing water that may be present. Ensure any flows are temporarily diverted around the portion of the ditch or watercourse where you are working.
- 11.6. Select appropriate equipment and work access routes to reduce damage to riparian vegetation and watercourse banks when using earth-moving equipment.
- 11.7. For smaller scale debris and sediment removal activities, remove materials by hand.
- 11.8. To assist with bank stability and invasive plant prevention, leave topsoil and root systems intact on channel banks surrounding your work area.
- 11.9. Ensure any works to repair damaged structures retain the pre-repair channel conditions (e.g., streambed profile, substrate, channel cross section) and do not constrict the stream width.
- 11.10. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.

Culverts

If a proposed culvert crosses a stream where fish are present, the crossing should be designed or upgraded to provide fish passage and avoid interference with fish habitat. To mitigate the



impact of culverts on fish movement technical assessment of the water flows and fish species is required to establish a culvert design that will allow for passage of fish. Often there are regional or provincial best practices available online and qualified professionals can assist with designs. Some best management practices for installation or replacement of culverts follows.

Culvert Design and Alternatives

Utilize alternative crossing structures (e.g. clear span bridges, lock blocks and concrete decks) as a replacement for culverts, where possible.

- 11.11. Ideally, crossings should have natural streambed material through them to allow continuous substrate that matches the streambed below and above the crossing. Open bottom crossings are ideal for maintaining natural substrate.
- 11.12. Utilize a single large culvert design over a multiple culverts design (i.e. several smaller culverts) to reduce debris blockage and increased fish and wildlife passage, where hydrologically feasible
- 11.13. Design culvert bottoms to be placed at least 30cm below the stream bed elevation to ensure culverts remain passable by fish and wildlife by preventing culverts from becoming perched.
- 11.14. A minimum water depth of 200 mm should be provided throughout the culvert length. To maintain this water depth at low flow periods an entrance/downstream pool can be constructed. In some cases, an upstream pool may also be necessary.
- 11.15. The culvert slope should follow the existing streambed slope where possible.
- 11.16. The culvert, inlet(s) and outlet(s) should be adequately protected with rip-rap to prevent erosion and scour around the culvert during high runoff events. The following measures should be incorporated when using replacement rock to stabilize the culvert:
 - o Place appropriately-sized, clean rocks into the eroding bank area by hand or machinery operating outside the water course.
 - o Do not obtain rocks from below the ordinary high water mark of any water body.
 - o Where possible, install rock at a slope similar to the stream bank to maintain a uniform stream profile and natural stream alignment. Otherwise, install the rock at the closest slope required to ensure it is stable.
 - o Ensure rock does not interfere with fish passage or constrict the channel width.
- 11.17. Trash racks should not be used near the culvert inlet. Accumulated debris may lead to severely restricted fish passage and potential injuries to fish. Where trash racks cannot be avoided in culvert installations, they must only be installed above the water surface indicated by bank full flow. A minimum of 9 inches clear spacing should be provided between trash rack vertical members. If trash racks are used, a long term maintenance plan must be provided along with the design, to allow for timely clearing of debris.
- 11.18. Natural or artificial supplemental lighting should be considered in new or replacement culverts that are over 150 feet in length.
- 11.19. Ensure designs locate culvert structures in areas that minimize impacts to riparian vegetation and associated wildlife.



Culvert Installation

- 11.20. It may be necessary to exclude fish from the immediate construction site while a culvert is being installed. If this practice is necessary, fish shall be salvaged by a qualified aquatics professional from within the exclusion area.
- 11.21. If dewatering is required refer to the [dewatering mitigation module](#) of this BMP for appropriate mitigations.
- 11.22. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.
- 11.23. Remove any old structures to a suitable upland disposal facility away from the riparian area and floodplain to avoid waste material from re-entering the watercourse

Wildlife Considerations for Culverts

At times, culverts are placed along portions of highways that bisect wetlands or specific habitats that support an abundance of wildlife. Consider building natural rock ledges through culverts to allow for small and medium-sized animals to walk on during periods of high flow.

12. Bridge Maintenance Mitigations Module

Bridge structure management activities include the cleaning and painting of bridge structures as well as the repair, rehabilitation, and replacement of bridge elements including decks, railings, abutments, and bearings. Works may include asphalt, concrete works, chipping, painting, grouting, timber truss, abutment and piling maintenance. These activities help ensure bridge structures remain structurally sound and safe for public use.

Timing of Works

- 12.1. Time work in water to respect [timing windows](#) to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics ecologists, provincial jurisdictions and DFO offices for further information on [timing windows](#) in your region.
- 12.2. Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- 12.3. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 12.4. Cover or otherwise contain stockpiled materials during heavy rain events or extended absences.
- 12.5. If the work schedule requires working in the rain, the area of work must be isolated with appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Bridge Cleaning

- 12.6. Schedule bridge-cleaning activities to coincide with the watercourse's spring freshet when possible. At freshet or during periods of high flow a large watercourse will often have its highest background levels of sediment. At this time, the introduction of a small amount of sediment to a watercourse (from bridge cleaning) will have a lower risk of potential impact when considered against those high natural background levels.



- 12.7. If works are planned outside the freshet or if your region does not experience a freshet, discuss the protocol and timing of these works with your local aquatics ecologist and/or DFO Officer.
- 12.8. Dry sweep and collect loose material off bridge surfaces before washing the bridge. Adequately seal drains and any open joints on the bridge deck before sweeping or washing to prevent material or sediment-laden wash water from entering any watercourse
- 12.9. If dry sweeping and preventing direct runoff to waterway is not a feasible way to clean the surface, discussion and planning with local aquatic ecologists will be required.
- 12.10. Use water alone. If your cleaning activities require degreasers or any other chemical, approval for use must be obtained from local aquatics specialists and/or DFO.
- 12.11. Contain any wash water or runoff to the bridge deck. Direct wash water towards the bridge approaches and away from the watercourse, then to a vegetated area or contained settling area (e.g., dry ditch channel unconnected to a watercourse) where it can infiltrate.
- 12.12. If superstructure cleaning is undertaken above or on the bridge deck level, prevent potentially harmful materials from entering into road drains. Block deck drains with suitable barriers (e.g., polyethylene or drain blocks) to prevent direct discharge to a watercourse, or re-route runoff through temporary piping onto adjacent settling pond or structure, using a hydro vacuum would be another option.
- 12.13. If water for cleaning is extracted from a watercourse, refer to [water withdrawal section](#) of this BMP.

Repairs Using Treated Wood Products

- 12.14. Untreated wood products are recommended, if treated wood is to be used, ensure it has been treated with a wood preservative appropriate for the project. Refer to the [Parks Canada Guide for the Use, Handling and Disposal of Pressure Treated Wood 2009](#) and any further updates from [Parks Canada Real Property – Environmental Management](#).
- 12.15. If treated timber must be cut to size, ensure cutting takes place away from the bridge and watercourse. Sawdust from treated wood is harmful to aquatic organisms and must be prevented from entering any watercourse.
- 12.16. Wood preservatives should be applied in a contained area and not be applied over or within 200m of water.

Bridge and Structure Painting

- 12.17. Ensure paint flakes, abrasive grits and abrasive/paint flake mixtures do not enter the watercourse as they may leach toxic heavy metals into receiving waters and/or be ingested by fish.
- 12.18. Install ground covers and/or vertical drapes such as sheets of plastic or air-permeable cloth (e.g., burlap or canvas) prior to removal activities to capture falling debris. Floating barges may be deployed in watercourses to capture falling debris, such as paint flakes and dust.
- 12.19. Waste materials collected during removal and application of protective coating operations (e.g., blasting abrasives, paint particles, rust and grease) should be



collected and retained for disposal at appropriate locations. Waste materials must not be deposited into watercourses or riparian areas.

- 12.20. Use hydro blasting or manual techniques, where possible, when removing road dirt, soluble salts and loose paint to minimize impacts to the watercourse.
- 12.21. Use water without cleaning agent additives if grease film removal is necessary.
- 12.22. Avoid use of toxic liquid paints, primers, solvents, degreasers and rust inhibitors.
- 12.23. Minimize spill potential by storing, mixing and transferring paints and solvents on land.

13. Water Withdrawal and Dewatering Mitigations Module

Construction often requires the use of water, many common methods of excavation and site isolation require dewatering. Temporary, short term water withdrawal provides an efficient uncontaminated water source for local project sites. Dewatering can allow sites to be effectively dry during construction, reducing the impact of sediment laden water entering fish bearing waters.

Timing Windows

- 13.1. As a general guide to prevent taking more water than aquatic system can support, limit total take of water to less than 5 successive days and less than 10 days in any period of 30 days.
- 13.2. Avoid water withdrawal during breeding seasons of amphibians and reptiles to avoid destruction of egg masses, consult local aquatics ecologist for site specific guidance.

Water Withdrawal

- 13.3. Water should not be withdrawn from a wetland or stream less than 5 metres wide at the surface or a lake less than one hectare in area.
- 13.4. Water withdrawal should follow the 10/90 rule which allows for up to 10% of the stream flow to be withdrawn, as long as the stream flow does not fall below the 90% exceedence flow (eg. 1 in 10 chance in a given year).
- 13.5. No permanent or semi-permanent works for water withdrawal should be placed in the stream channel.
- 13.6. Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish, amphibians and/or reptiles. Entrainment occurs when a fish or amphibian is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish, reptile or amphibian is held in contact with the intake screen and is unable to free itself.

Pump Screens

- 13.7. In freshwater, fish-bearing waters design and installation of intake end-of-pipe fish screens:
 - o Locate screen in areas and depths of water with low concentrations of fish throughout the year away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
 - o Orient the screen face in the same direction as the flow of water.
 - o Ensure openings in the guides and seals are less than the opening criteria to make “fish tight”.



- Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
- Provide structural support to the screen panels to prevent sagging and collapse of the screen. Large cylindrical and box type screens should have a manifold installed to ensure even water velocity distribution across the screen surface. The end of the structure should be made of solid materials and the end of the manifold capped.
- Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where debris loading (woody material, leaves, algae mats, etc.) is a concern. A 150 mm (6 in.) spacing between bars is typical.
- Provision should be made for the removal, inspection, and cleaning of screens.
- Ensure regular maintenance and repair of cleaning apparatus, seals, and screens to prevent debris fouling and impingement of fish.
- Pumps must be shut down when fish screens are removed for inspection and cleaning.

Dewatering

- 13.8. A site specific dewatering plan is required be provided before commencing a pump-out sump to dewater excavation sites with specific details on how and where the water will be discharge.
- 13.9. Site specific mitigations may be required depending on the conditions of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond reclamation.
- 13.10. Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the SO.
- 13.11. Soil and vegetation erosion protection is required for water pumped on to land.



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Appendix 1 Regulatory Guidance

Jurisdictions

While all projects on lands managed by Parks Canada must adhere to Federal law and regulation, it is considered best practice to refer to local community, regional, provincial regulation and best practices where federal guidance is silent and/or attempt to meet those targets if it can reduce the overall impact of the project.

Some of the project activities reviewed have potential environmental impacts that are addressed by various provincial, federal and territorial acts and regulations. All activities must meet current environmental law and regulations in their design and construction. The following is a brief description of some of the key federal acts and regulations. Further review, understanding and application of other federal, provincial and territorial environmental laws are part of a rigorous approach to project planning and execution.

Canada National Parks Act and Regulations-Parks Canada

All work inside National Parks and Protected Areas must be performed in accordance with the laws and regulations set out in the ***Canada National Parks Act*** and Regulations. This includes the requirement for most activities described to only be done under a permit such as: business licence for contractor, disturbance of natural objects, travel in restricted areas, special events or use of disposal sites.

Fisheries Act - Fisheries and Oceans Canada

If a project is to be conducted near water, it is the proponent's responsibility to ensure they avoid causing [serious harm to fish](#) in compliance with the ***Fisheries Act***. The [advice in on the Fisheries and Oceans website](#) will help a proponent avoid causing harm and comply with the Act.

If the water body in the project area has fish or is connected to waters at any time that have fish the project must meet the [self assessment criteria on the Fisheries and Oceans website](#), if not a project review can be made by Fisheries and Oceans Canada to assess whether the project requires authorization or authorization can be requested directly. Given the level of detail required for a review and/or authorization request the EIA officer may need to consider a more involved EIA pathway in those circumstances.

Migratory Bird Convention Act – Environment Canada

The purpose of this Act is to implement the Convention by protecting and conserving migratory birds - as populations and individual birds - and their nests. Section 6 - prohibits the disturbance, destruction, or taking of a nest, egg, or nest shelter of a migratory bird.

In Canada, the general nesting period may start as early as mid-March and may extend until end of August. This is a general nesting period that covers most federally protected migratory bird species. This period varies regionally across Canada mainly due to differences in species assemblages, climate, elevation and habitat type. Generally, the nesting period is delayed in more northerly latitudes, corresponding to vegetation development and food availability. (Environment Canada, 2014). To help with determining regionally relevant periods where



nesting is likely to occur, Environment Canada is publishing estimated regional nesting periods within large geographical areas across Canada referred as "nesting zones". These periods are estimated for each zone and consider the time of first egg-laying until the young have naturally left the vicinity of the nest. Field Units may wish to refine this section and add their known local nesting periods.

Species at Risk Act

If a species listed under the ***Species at Risk Act*** (SARA) is found within the project area, any potential adverse effects from the proposed project to the individuals of the species, their residences and/or their critical habitat must be understood. Species at risk considerations require specific expertise, due to additional legal requirements under the SARA and CEAA 2012. If the projects or activities to be addressed by the BMP could affect a listed species or its critical habitat, the EIA officer may need to consider a more involved EIA pathway in those circumstances.

APPENDIX B
Geotechnical Report

Geotechnical Investigation
Rocky Barachois Bridge Replacement,
Gros Morne National Park, NL

File No: 163545



Prepared for:
Harbourside Engineering Consultants
219 Waverley Rd., Suite 200
Dartmouth, NS B2X 2C3

Prepared by:
Harbourside Geotechnical Consultants
219 Waverley Rd., Suite 200
Dartmouth, NS B2X 2C3

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TABLE OF CONTENTS

1.0	INTRODUCTION.....	5
2.0	SITE DESCRIPTION AND GEOLOGY.....	6
3.0	INVESTIGATIVE PROCEDURES	7
3.1	General.....	7
3.2	Boreholes	7
3.3	Test Pits.....	7
3.4	Push Probes	8
3.5	Laboratory Testing	8
3.6	Surveying.....	8
4.0	SUBSURFACE CONDITIONS	9
4.1	Bridge Abutments (Boreholes BH01 to BH07).....	9
4.1.1	Asphalt.....	11
4.1.2	Fill.....	11
4.1.3	Original Rootmat and Topsoil.....	12
4.1.4	Sand and Gravel.....	12
4.1.5	Silty Sand/Silty Gravel	13
4.1.6	Bedrock	14
4.1.7	Groundwater	15
4.2	North Bridge Approach (Test Pits TP01 to TP04).....	15
4.2.1	Surficial Layer	17
4.2.2	Fill: Sand and Gravel	17
4.2.3	Sand and Gravel.....	17
4.2.4	Bedrock	17
4.2.5	Groundwater	17
4.3	South Bridge Approach (Test Pits TP06 to TP09 and Push Probes PP05 to PP08)	18
4.3.1	Rootmat and Topsoil.....	20
4.3.2	Fill.....	20
4.3.3	Original Rootmat and Topsoil.....	20
4.3.4	Gravel.....	20
4.3.5	Clay	20
4.3.6	Bedrock	21
4.3.7	Groundwater	21
4.3.8	Push Probes	21

5.0	DISCUSSION AND RECOMMENDATIONS	23
5.1	Site Preparation	23
5.2	Excavations in Soil.....	23
5.3	Excavations in Rock.....	24
5.4	Water Control.....	24
5.5	Structural Fill.....	24
5.6	Approach Fill.....	25
5.7	Slope Stability	25
5.8	Foundations.....	26
5.8.1	General.....	26
5.8.2	Driven Pile Foundations.....	26
5.8.3	Drilled Pile Foundations	27
5.8.4	Lateral Pile Behaviour.....	28
5.9	Backfill	29
5.10	Pavement Design	29
5.11	Geotechnical Parameters.....	30
5.12	Winter Weather Conditions	30
5.13	Seismic Site Classification	30
6.0	CLOSURE.....	31

LIST OF TABLES

Table 1	Summary of Subsurface Conditions Near Abutments	10
Table 2	Particle-Size Analyses – Fill: Base Gravel (Bridge Abutments).....	11
Table 3	Particle-Size Analyses – Fill: Sand and Gravel (Bridge Abutments).....	12
Table 4	Particle-Size Analyses – Sand and Gravel (Bridge Abutments)	13
Table 5	Particle-Size Analyses – Silty Sand (Bridge Abutments).....	14
Table 6	Unconfined Compressive Strength Test Results.....	15
Table 7	Summary of Subsurface Conditions near North Approach.....	16
Table 8	Particle-Size Analyses – Fill: Sand and Gravel (North Bridge Approach).....	17
Table 9	Summary of Subsurface Conditions near South Approach	19
Table 10	Particle-Size Analyses – Gravel (South Bridge Approach).....	20
Table 11	Particle-Size Analyses and Atterberg Limits – Lean Clay (South Bridge Approach).21	
Table 12	Push Probe Locations and Penetration Depth	22
Table 13	Factored Axial Resistance at ULS for Driven Piles	26
Table 14	Factored Socket Resistance at ULS for Drilled Piles in Bedrock.....	28
Table 15	Depth to Fixity	29
Table 16	Pavement Structure.....	29
Table 17	Unfactored Geotechnical Parameters.....	30

LIST OF APPENDICES

Appendix A	Symbols and Terms Used on Borehole and Test Pit Records Borehole Records BH01 to BH07 Test Pit Records TP01 to TP04 and TP06 to TP09
Appendix B	Particle-Size Analyses
Appendix C	Sketch No. G1, Borehole Location Plan Sketch No. G2, Test Pit and Push Probe Location Plan

1.0 INTRODUCTION

Acting on the request and authorization of Harbourside Engineering Consultants (HEC), on behalf of Parks Canada Agency, Harbourside Geotechnical Consultants (HGC) have completed a geotechnical investigation for the proposed replacement of the Rocky Barachois Bridge in Gros Morne National Park, Newfoundland and Labrador.

The existing Rocky Barachois Bridge is a two-lane, single-span concrete girder bridge with a reinforced concrete deck. The structure carries Newfoundland and Labrador Route 430 over Rocky Barachois Brook.

The purpose of this geotechnical investigation was to determine the subsurface soil and rock conditions at the site and to provide geotechnical recommendations to aid with replacement of the Rocky Barachois Bridge.

The scope of work completed for this project includes the following:

- Completion of a geotechnical field investigation, completed in three phases and consisting of seven boreholes, eight test pits, and a series of push probes;
- A laboratory testing program; and
- Preparation of this report detailing the findings of the field investigation and laboratory analyses, as well as discussion and recommendations to aid with site earthworks and foundation design.

This report has been prepared specifically and solely for the project described herein and contains all of the findings of this investigation.

2.0 SITE DESCRIPTION AND GEOLOGY

Rocky Barachois Bridge, located between Rocky Harbour and Deer Lake, carries Newfoundland and Labrador Route 430 over Rocky Barachois Brook along the East Arm of Bonne Bay. At the bridge, Rocky Barachois Brook flows in a westerly direction from the Long Range Mountains into the East Arm. The immediate north approach to the bridge is relatively flat and appears to have been constructed in the water to shorten the span of the existing structure. The south approach has a long, sweeping, left-turning horizontal curve (looking from the bridge) on the immediate approach to the bridge with the road gradient rising to the south, away from the bridge. An unpaved road providing access to a pit or quarry is located on the east side of the north approach, approximately 300 m from the bridge.

The location of the existing bridge is shown on Sketch G1, Borehole Location Plan and Sketch G2, Test Pit and Push Probe Location Plan in Appendix C.

Surficial geologic mapping near the bridge indicates that the principal overburden soils consist of glaciofluvial deposits of fine-grained sand to coarse-grained cobbly gravel. Bedrock geology at the site is mapped as Paleozoic sedimentary rocks of the Labrador Group (Hawke Bay Formation and Forteau Formation) including quartzose sandstone (quartz arenite), sandstone, carbonate, and shale.

3.0 INVESTIGATIVE PROCEDURES

3.1 GENERAL

The first phase of the geotechnical investigation, comprised of two boreholes, was conducted between September 17 and 22, 2016. The second phase, which consisted of five boreholes, four test pits, and a series of push probes was conducted between November 25 and December 5, 2016. The third phase, which consisted of four test pits, was conducted on May 28, 2017. Samples of the soil and bedrock were recovered from the test locations, classified in the field, and taken to our geotechnical laboratory for final classification and testing. A detailed summary of the soil and bedrock conditions encountered, as well as the sampling and testing carried out, is presented on the borehole records and test pit records in Appendix A. A document entitled “Symbols and Terms used on Borehole and Test Pit Records”, which clarifies terms used through this report and symbols used on the borehole and test pit records, is also included in Appendix A.

3.2 BOREHOLES

To support construction of the new Rocky Barachois Bridge, three boreholes were advanced in the vicinity of the north abutment of the existing structure (BH01, BH06, and BH07), three in the vicinity of the south abutment (BH02, BH04 and BH05), and one east of the south approach (BH03). Conditions at each test location were observed and logged by experienced geotechnical personnel. Boreholes were drilled to depths ranging from 16.8 to 36.1 m below the ground surface. Upon completion of drilling, standpipe was installed in five boreholes (BH01, and BH03-BH06). Water levels were measured on December 4, 2016 as indicated on the borehole records in Appendix A, however, at the time of measuring, the standpipe was blocked in three of the boreholes (BH03, BH04, and BH06).

Boreholes were advanced using a combination of 100-mm flight augers, HW-sized casing, and NW-sized casing. Soil sampling was carried out at regular intervals using conventional 50-mm diameter split spoon samplers while performing standard penetration testing as described in *ASTM D1586 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*. The standard penetration test (SPT) “N-value” is the number of blows required to advance a 50-mm outer-diameter split-spoon sampler a distance of 300 mm into the soil using a standardized drop height and weight. N-values generally provide an indication of soil consistency or compactness and may also be used to aid in estimation of other soil parameters. Occasionally, a 76-mm split-spoon sampler was used to retrieve samples with relatively large particle sizes. A record of the sampling is included on the borehole records in Appendix A.

Bedrock was cored using HQ- and NQ-sized diamond coring bits. The recovery and rock quality designation (RQD) of each run of core was recorded.

3.3 TEST PITS

Four test pits were advanced east of the existing north approach (TP01, TP02, TP03, and TP04), and four test pits were advanced east of the existing south approach (TP06, TP07, TP08, and TP09) near the maximum (most eastern) extents of the alignments for the design options being considered. Test pits were excavated to depths ranging from 0.9 to 4.6 m below the ground surface using a track-mounted excavator. The subsurface conditions were visually observed with compactness/consistency inferred based on excavator performance. Soil samples were taken from select locations of the various strata encountered.

3.4 PUSH PROBES

A series of four push probes were put down east of the existing south approach to the bridge. These were advanced while visually inspecting the area in the vicinity of the most eastern extents of the proposed alignments. The depths of the probes may be used to estimate the thickness of loose or soft surficial materials, however, these probes do not provide any information on the type or extent of material below the depth of refusal.

3.5 LABORATORY TESTING

All soil samples recovered from the test locations were stored in water-tight containers and taken to our geotechnical laboratory for final classification and testing. Laboratory testing on select soil samples included water content determinations (*ASTM D2216 Standard Test Methods for Laboratory Determination of Water Content of Soil and Rock by Mass*), and particle-size analyses (*ASTM D6913 Standard Test Method for Particle-Size Distribution of Soils Using Sieve Analysis*).

Samples of bedrock were stored in core boxes and returned to our geotechnical laboratory. Testing was performed on select samples of rock core to determine the unconfined compressive strength (*ASTM D7012-14 Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures*).

A summary of the testing performed is presented on the borehole records and test pit records in Appendix A and in separate figures in Appendix B. Soil descriptions used throughout this report are in general accordance with the Unified Soil Classification System (*ASTM D2487 Standard Practice for Classification of Soils for Engineering purposes / ASTM D2488 Standard Practice for Description and Identification of Soils*).

3.6 SURVEYING

The locations and ground surface elevations for each borehole were surveyed by Yates and Woods LTD. Elevations are referenced to the Canadian Geodetic Vertical Datum of 1928 (CGVD28).

4.0 SUBSURFACE CONDITIONS

4.1 BRIDGE ABUTMENTS (BOREHOLES BH01 TO BH07)

The subsurface conditions encountered near the existing abutments generally consisted of the following sequence:

- Asphalt
- Fill
- Original rootmat and topsoil
- Sand and gravel
- Silty sand/silty gravel
- Bedrock

Not all strata were encountered at all test locations. The subsurface conditions observed in the boreholes are summarized in Table 1 and the following paragraphs and are described in additional detail on the borehole records in Appendix A.

Table 1 Summary of Subsurface Conditions Near Abutments

Location	Ground Elevation ^(a) (m)	Thickness						Bedrock		Groundwater	Total Depth (m)
		Asphalt (m)	Fill (m)	Original Rootmat / Topsoil (m)	Sand and Gravel (m)	Silty Sand / Silty Gravel (m)	Depth to Surface (m)	Surface Elevation ^(a) (m)	Depth (m)	Elevation ^(a) (m)	
BH01	6.86	0.13	5.97	-	9.34	-	> 21.41	< -14.55	6.8	0.1	21.41
BH02	7.70	0.13	7.44	-	> 9.19	-	> 16.76	< -9.06	-	-	16.76
BH03	2.17	-	1.22	-	9.19	2.59	17.98	-15.81	> 2.1	< 0.1	20.50
BH04	7.61	0.15	8.23	0.25	12.61	0.66	29.31	-21.70	> 0.5	< 7.1	31.98
BH05	7.53	0.18	8.45	-	12.95	4.07	28.99	-21.46	7.2	0.3	36.07
BH06	6.85	0.15	7.32	-	10.07	-	26.54	-19.69	> 6.0	< 0.9	29.59
BH07	6.88	0.15	7.93	-	9.45	3.88	27.68	-20.80	-	-	34.54

(a) Elevations are referenced to CGVD28.

4.1.1 Asphalt

A layer of asphalt was encountered at the surface of all boreholes advanced through the existing road embankment (boreholes BH01, BH02, and BH04-BH07)

Where encountered, the asphalt was approximately 130 to 180 mm thick.

4.1.2 Fill

Fill was encountered at the surface of borehole BH03 (where it was placed to construct a temporary access pad) and below the asphalt in the six boreholes advanced through the existing roadway. Generally, the fill encountered in the boreholes can be divided into three groups: access pad, base gravel, and sand and gravel.

Access Pad

Brown silty sand fill, approximately 1.2 m thick, was encountered at the surface of BH03. This fill consisted of material placed when constructing a temporary access pad out of local material. Based on our field classification, the fill may be described as silty sand with gravel.

Base Gravel

A layer comprised of grey to greyish-brown sand and gravel was encountered below the asphalt in the six boreholes advanced through the existing embankment. This layer forms part of the pavement structure and, where encountered, ranged from 0.8 to 1.8 m in thickness.

The results of particle-size analyses on three samples of the base gravel is presented in Table 2. Based on our field classification and laboratory testing, the base gravel may be described as silty sand with gravel to gravel with silt and sand.

The water content of three samples from this layer were 4, 4, and 5 percent.

Table 2 Particle-Size Analyses – Fill: Base Gravel (Bridge Abutments)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (percent)		
				Gravel	Sand	Fines ^(b)
BH02	SS1	0.3 to 0.9	Silty Sand with Gravel	35	51	14
BH04	SS1	0.3 to 0.9	Well-Graded Sand with Silt and Gravel	39	48	12
BH06	SS1	0.3 to 0.9	Well-Graded Sand with Silt and Gravel	32	55	12

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

Sand and Gravel

Brown to grey fill comprised of sand, gravel, and silt was encountered below the base gravel in all boreholes advanced through the existing road embankment. At the borehole locations, the thickness of this fill ranged from 5.2 to 7.3 m.

The results of particle-size analyses on three samples from the sand and gravel fill is presented in Table 3. Based on our field classification, visual-manual inspection, and laboratory testing, the sand and gravel fill may be described as silty sand with gravel to gravel with sand. Occasional wood fragments were noted in borehole BH02 at depths of approximately 8.5 m. Frequent cobbles

and boulders were encountered in several boreholes and are anticipated to occur throughout the layer.

The water content of eleven samples of the sand and gravel fill from the boreholes ranged from 1 to 11 percent with an average of 8 percent.

Table 3 Particle-Size Analyses – Fill: Sand and Gravel (Bridge Abutments)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (%)		
				Gravel	Sand	Fines ^(b)
BH01	SS2	0.9 to 1.5	Well-Graded Sand with Silt and Gravel	34	57	9
BH05	SS2	2.0 to 2.6	Well-Graded Sand with Silt and Gravel	30	56	13
BH05	SS6	5.8 to 6.5	Poorly Graded Gravel with Silt and Sand	55	35	11

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

4.1.3 Original Rootmat and Topsoil

A layer of brown to black silty sand with some organic material was encountered below the fill in BH04. This layer was the rootmat and topsoil at the ground surface before placement of the overlying fill. The layer contained roots and decaying vegetable matter.

4.1.4 Sand and Gravel

A layer of sand and gravel was encountered below the rootmat and topsoil in BH04 and below the fill in the other six boreholes. On the north side of the brook, in boreholes that were advanced through this layer, the thickness ranged from 15.7 m (BH07) to 19.1 m (BH06). South of the brook the thickness ranged from 9.2 m (BH05) to 20.0 m (BH04).

Occasional wood fragments were noted in BH02; frequent cobbles and boulders were encountered in most boreholes and are anticipated to occur throughout the deposit. The results of particle-size analyses of nineteen samples from the sand and gravel materials are presented in Table 4, below. Based on our field classification, visual-manual inspection, and laboratory testing soil classifications on retrieved samples ranged from silty sand to gravel with sand, however, the layer can generally be described as sand with silt and gravel to gravel with silt and sand.

The natural water contents of thirty-five samples tested from this layer ranged from 3 to 18 percent with an average of 10 percent.

Within this layer, SPT N-values ranged from 10 to sampler refusal. However, many N-values were elevated due to gravel and cobbles obstructing the advancement of the split-spoon sampler during testing and the layer can generally be described as compact to dense.

Table 4 Particle-Size Analyses – Sand and Gravel (Bridge Abutments)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (%)		
				Gravel	Sand	Fines ^(b)
BH01	SS10	6.1 to 6.7	Well-Graded Sand with Silt and Gravel	45	49	6
BH01	SS16	9.9 to 10.5	Well-Graded Gravel with Sand	60	38	3
BH01	SS24	15.4 to 16.1	Silty Sand	6	80	14
BH01	SS28	18.4 to 19.0	Well-Graded Sand with Silt and Gravel	41	54	6
BH02	SS9	8.2 to 8.8	Well-Graded Sand with Silt and Gravel	35	55	11
BH02	SS10	9.1 to 9.7	Well-Graded Gravel with Silt and Sand	48	42	10
BH03	SS5	3.7 to 4.3	Well-Graded Sand with Silt and Gravel	28	64	8
BH03	SS10	7.2 to 7.9	Silty Sand	0	87	13
BH04	SS14	9.6 to 10.2	Well-Graded Gravel with Silt and Sand	49	44	7
BH04	SS25	27.7 to 23.3	Well-Graded Sand with Silt and Gravel	29	63	9
BH05	SS11	9.0 to 9.7	Well-Graded Sand with Silt and Gravel	34	54	11
BH05	SS16	14.9 to 15.5	Well-Graded Sand with Silt and Gravel	19	71	10
BH05	SS18	18.0 to 18.6	Well-Graded Gravel with Sand	61	36	3
BH05	SS21	22.5 to 23.1	Poorly Graded Sand with Silt and Gravel	19	76	5
BH06	SS11	7.4 to 8.0	Poorly Graded Sand with Silt and Gravel	47	49	5
BH06	SS22	15.7 to 16.3	Well-Graded Sand with Silt and Gravel	36	57	7
BH06	SS26	19.5 to 20.1	Well-Graded Sand with Silt and Gravel	43	49	8
BH07	SS11	8.1 to 8.7	Well-Graded Sand with Silt and Gravel	36	52	12
BH07	SS24	20.1 to 20.7	Well-Graded Sand with Silt and Gravel	42	51	7

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

4.1.5 Silty Sand/Silty Gravel

A layer of silty gravel to silty sand was encountered below the sand and gravel layer in four of the seven boreholes (BH03-BH05, BH07). Boreholes BH01 and BH02 were terminated in the overlying layers and the silty sand to silty gravel layer was not encountered in BH06 but its

presence may have been obfuscated by poor drilling recovery. Where encountered, the thickness of this layer ranged from 0.7 m (BH04) to 4.1 m (BH05).

The results of particle-size analyses of three samples of this layer are presented in Table 5. Based on our field classification, visual-manual inspection, and the laboratory testing the layer can generally be described as silty sand to silty gravel with sand.

The natural water contents of two samples from this layer were 9 and 17 percent. Based on SPT N-values, this layer may generally be described as dense to very dense.

Table 5 Particle-Size Analyses – Silty Sand (Bridge Abutments)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (%)		
				Gravel	Sand	Fines ^(b)
BH03	SS18	16.7 to 17.4	Silty Sand	13	52	35
BH05	SS23	25.3 to 25.9	Silty Gravel with Sand	31	27	41
BH07	SS30	25.5 to 26.1	Silty Sand with Gravel	38	49	14

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

4.1.6 Bedrock

Bedrock was encountered and cored in five of the seven boreholes advanced as part of this investigation.

North of the brook, in boreholes BH06 and BH07, the bedrock surface was encountered at elevations of -19.7 and -20.8 m, respectively. South of the brook and near the existing abutment, in boreholes BH04 and BH05, the bedrock surface was encountered at elevations of - 21.7 and - 21.5 m, respectively. At borehole BH03, which was advanced south of the brook and east of the existing abutment, bedrock was encountered at an elevation of -15.8 m.

Bedrock was primarily pink to light purple quartzose sandstone (quartz arenite). At the bottom of BH04, conglomeratic quartzose sandstone was encountered in which secondary voids have developed due to the dissolution and chemical leaching of soluble minerals (e.g. carbonate pebbles). The colour of the bedrock varied from the pink and light purple most commonly observed to white in BH04, light brown in BH05, and grey to purplish-grey in BH06.

Based on the RQD of the recovered core, the bedrock may generally be classified as very poor to poor quality with portions that may be classified as fair to good quality (more commonly on the north side of the brook).

Four unconfined compressive strength tests were performed on samples of the quartzose sandstone and one on the conglomeratic quartzose sandstone. Results of the tests ranged from 13 MPa (with failure occurring along an existing fracture) to 146 MPa. Based on these tests and field testing, the quartz arenite may generally be classified as strong to very strong and the conglomeratic quartzose sandstone as weak. The results of the unconfined compressive strength tests are provided in Table 6, below.

Table 6 Unconfined Compressive Strength Test Results

Borehole	Depth (m)	Rock Type	Unconfined Compressive Strength (MPa)
BH04	31.5	Conglomeratic Quartzose Sandstone	13 ^(a)
BH05	32.0	Quartzose Sandstone	24
BH06	29.0	Quartzose Sandstone	146
BH07	32.0	Quartzose Sandstone	93

(a) Sample failed along existing fracture.

4.1.7 Groundwater

The groundwater level in Rocky Barachois Brook at the location of the investigation is influenced by the ocean and its tides.

Groundwater levels were measured in boreholes BH01 and BH05 on September 22 and December 4, 2016, respectively. Near the north abutment (BH01) the water level was 6.8 m below the ground surface (el. 0.1 m) and near the south abutment (BH05) the water level was 7.2 m below the ground surface (el. 0.3 m). Standpipes were also installed in boreholes BH03, BH04, and BH06 but the standpipes were blocked at depths of 2.1, 0.5, and 6.0 m, respectively.

Water levels may fluctuate with tides, brook level, construction activity, precipitation events, as well as individual weather events and climatic and seasonal weather trends.

4.2 NORTH BRIDGE APPROACH (TEST PITS TP01 TO TP04)

The subsurface conditions encountered in the test pits near the north approach generally consisted of the following sequence:

- Rootmat and topsoil
- Fill
- Sand and gravel

The subsurface conditions observed are summarized in Table 7 and the following paragraphs and are described in additional detail on the test pit records in Appendix A.

Table 7 Summary of Subsurface Conditions near North Approach

Location	Ground Elevation ^(a) (m)	Thickness			Bedrock		Groundwater		Total Depth (m)
		Rootmat/ Topsoil (m)	Fill (m)	Sand and Gravel (m)	Depth to Surface (m)	Surface Elevation ^(a) (m)	Depth (m)	Elevation ^(a) (m)	
TP01	4.8	0.1	3.6	-	> 3.7	< 1.1	> 3.7	< 1.1	3.7
TP02	4.2	0.1	2.8	-	> 2.9	< 1.3	> 2.9	< 1.3	2.9
TP03	5.5	0.1	3.1	-	> 3.2	< 2.3	> 3.2	< 2.3	3.2
TP04	1.8	0.2	-	2.1	> 2.3	< -0.5	1.1	0.7	2.3

(a) Elevations are referenced to CGVD28.

4.2.1 Surficial Layer

A surficial layer of rootmat and topsoil was encountered in all four test pits advanced near the north approach. At the test locations this layer was 0.1 to 0.2 m thick.

4.2.2 Fill: Sand and Gravel

Brown to grey fill was encountered below the surficial layer in test pits TP01 to TP03. Due to the limits of the excavator reach and the limits of practical excavation due to cave-in of the granular material, the test pits were not advanced through the full extents of this layer, which was in excess of 2.9 to 3.6 m thick. Occasional to frequent cobbles and boulders were encountered throughout the layer.

The results of particle-size analyses on three samples from the fill materials are presented in Table 8, below. Based on our field classification and the particle-size analyses the layer may be described as gravel with sand.

The in-situ water content of three samples of the fill were 3, 3, and 4 percent.

Table 8 Particle-Size Analyses – Fill: Sand and Gravel (North Bridge Approach)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (%)		
				Gravel	Sand	Fines ^(b)
TP01	GB1	1.8 to 2.1	Poorly Graded Gravel with Sand	58	39	3
TP02	GB1	2.4 to 2.7	Poorly Graded Gravel with Sand	55	42	2
TP03	GB1	1.8 to 2.1	Well-Graded Gravel with Sand	64	33	3

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

4.2.3 Sand and Gravel

A layer of greyish-brown gravel with silt and sand was encountered below the surficial layer in TP04. The test pit extended 2.1 m into this layer and was terminated within it.

Based on field observations, including excavator performance, this layer may be described as compact.

4.2.4 Bedrock

Bedrock was not encountered in any test pits advanced along the north approach. However, bedrock outcrops were observed along the road about 600 m north of the bridge.

4.2.5 Groundwater

Groundwater was noted in TP04 at a depth of 1.1 m below grade (el. 0.7 m). No water infiltration was noted in the other test pits while the excavations were open.

4.3 SOUTH BRIDGE APPROACH (TEST PITS TP06 TO TP09 AND PUSH PROBES PP05 TO PP08)

The subsurface conditions encountered at the south approach generally consisted of the following sequence:

- Rootmat and topsoil
- Fill
- Original rootmat and topsoil
- Clay
- Sand and gravel
- Clay
- Bedrock

Not all strata were encountered at all test locations. The subsurface conditions observed in the test pits are summarized in Table 9 and the following paragraphs and are described in additional detail on the test pit records in Appendix A.

Table 9 Summary of Subsurface Conditions near South Approach

Location	Ground Elevation ^(a) (m)	Thickness						Bedrock		Groundwater		Total Depth (m)
		Rootmat/ Topsoil (m)	Fill (m)	Original Rootmat / Topsoil (m)	Clay (m)	Gravel (m)	Clay (m)	Depth to Surface (m)	Surface Elevation ^(a) (m)	Depth (m)	Elevation ^(a) (m)	
TP06	6.0	0.3	-	-	-	4.3	-	>4.6	<1.4	3.0	3.0	4.6
TP07	14.2	0.2	-	-	-	0.7	-	0.9	13.3	>0.9	<13.3	0.9
TP08	17.1	0.2	-	-	1.0	0.8	-	2.0	15.1	>2.0	<15.1	2.0
TP09	23.3	0.2	1.6	0.3	-	0.9	1.3	4.3	19.0	>4.3	<19.0	4.3

(a) Elevations are referenced to CCVD28.

4.3.1 Rootmat and Topsoil

A layer of rootmat and topsoil was encountered at the surface of all four test pits advanced on the south approach. At the test locations, this layer was 0.2 to 0.3 m thick.

4.3.2 Fill

Fill was encountered below the rootmat and topsoil in test pit TP09. The fill consisted of a layer of brown sandy clay overlying brown silty gravel with sand. The total thickness of the fill at this location was 1.6 m.

4.3.3 Original Rootmat and Topsoil

A Layer of brown to black silty sand with some organic material was encountered below the fill in test pit TP09. This layer was the rootmat and topsoil of the ground surface before placement of the overlying fill. The layer contained roots, rootlets, and decaying vegetable matter. Based on field observations including excavator performance, the compactness of this layer may be described as loose.

4.3.4 Gravel

A layer of brown to grey gravel with sand was encountered below the surficial layer in test pits TP06 and TP07, below the clay layer in test pit TP08 and below the original rootmat and topsoil in test pit TP09. Where encountered, the thickness of this layer ranged from 0.7 to 4.3 m. Based on field observations including excavator performance, the compactness of this layer may be described as loose to dense. Occasional cobbles and boulders were encountered throughout the layer.

The results of particle-size analyses on three samples of the gravel are presented in Table 10. Based on our field classification and the particle-size analyses, the layer may be described as silty gravel with sand to gravel with sand and silt.

The natural water content of three samples of the gravel were 6, 8, and 8 percent.

Table 10 Particle-Size Analyses – Gravel (South Bridge Approach)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (%)		
				Gravel	Sand	Fines ^(b)
TP06	GB1	1.2 to 1.5	Well-Graded Gravel with Sand	75	23	2
TP06	GB2	4.3 to 4.6	Poorly Graded Gravel with Sand	51	48	1
TP08	GB2	1.5 to 1.8	Silty Gravel with Sand	48	34	18

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

4.3.5 Clay

A layer of brown lean clay was encountered below the surficial layer in test pit TP08 and below the gravel layer in test pit TP09. At these two locations, the clay was 1.0 to 1.3 m thick. The results of particle-size analyses and Atterberg limit testing on two samples of the clay are presented in

Table 11. Based on our field classification, the particle-size analysis, and the Atterberg limits, this deposit may be classified as lean clay.

Field observations including minivane, torvane, and pocket penetrometer testing indicate that the clay may generally be described as stiff.

The natural water content of two samples of the clay were 16 and 24 percent.

Table 11 Particle-Size Analyses and Atterberg Limits – Lean Clay (South Bridge Approach)

Location	Sample No.	Sample Depth (m)	ASTM Soil Classification ^(a)	Material Composition by Weight (%)			Atterberg Limits		
				Gravel	Sand	Fines ^(b)	PL	LL	PI
TP08	GB1	0.9 to 1.2	Lean Clay	0	8	91	15	30	15
TP09	GB2	3.9 to 4.3	Lean Clay	0	6	94	16	30	14

(a) See ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

(b) For particle-size analyses performed by sieve, the percent of silt- and clay-sized particles are reported collectively as the percent fines.

4.3.6 Bedrock

Bedrock was inferred based on excavator refusal in three of the four test pits (TP07, TP08, and TP09). In these test pits, bedrock was encountered at depths ranging from 0.9 to 4.3 m. Test pit TP06 was advanced to a depth of 4.6 m and bedrock was not encountered.

Bedrock outcrops were observed along the road about 200 m south of the bridge. The location of one bedrock outcrop south of the bridge was recorded and its position (N 5 480 789, E 446 972) is shown on Sketch G2 in Appendix C.

4.3.7 Groundwater

Water infiltration was observed in TP06 at a depth of 3.1 m below grade (el. 3.0 m). No water infiltration was noted in the other test pits along the south approach.

4.3.8 Push Probes

The depth of penetration of the push probes advanced as part of this investigation ranged from 0.05 m to 0.75 m and are summarized in Table 12, below. The depths of the probes may be used to estimate the thickness of very loose and soft surficial materials however these probes do not determine any information on the type or consistency of material below the depth of refusal.

Table 12 Push Probe Locations and Penetration Depth

Probe Location	Probe Depth (mm)	Description/Observations	Northing	Easting
PP05	750	<ul style="list-style-type: none"> Probe on low-lying wet area at base of slope Frequent cobbles and boulders visible at ground surface in vicinity of probe 	5 480 880	446 890
PP06	100	<ul style="list-style-type: none"> Probe on forest bottom 	5 480 848	446 926
PP07	200	<ul style="list-style-type: none"> Probe on forest bottom Occasional cobbles visible at ground surface in vicinity of probe 	5 480 820	446 967
PP08	50	<ul style="list-style-type: none"> Probe on forest bottom Occasional boulders visible at ground surface in vicinity of probe 	5 480 798	447 013

5.0 DISCUSSION AND RECOMMENDATIONS

We understand that the preferred design of the new bridge is a 42-m single-span structure. The new alignment will be skewed to the existing alignment and offset to the east by about 14.0 m at mid-span. The new structure will be constructed while traffic remains on the existing structure. Once the new structure is complete, traffic will be diverted on to the new structure and the existing bridge will be demolished.

As part of this work, both the north and south approach will be realigned to the east of the current road. This work will require infilling adjacent to the existing embankments and potential reworking of the existing fills. To reach the proposed grade, we have estimated that fills up to about 5 to 7 m above the existing grade may be required.

The following subsections provide geotechnical recommendations to support site preparation and foundation design based on our geotechnical investigation and our understanding of the proposed design options.

5.1 SITE PREPARATION

All rootmat, topsoil, and other deleterious materials (e.g. soft or loose soils, or soils containing a significant proportion of organic material) should be removed from below the footprint of the pile caps, structural fills, and new approach fills to expose the in-situ sand gravel fill or native sand and gravel. The push probes encountered soft or very loose surficial soils up to 0.75 m thick, and the thicknesses of these soils likely exceed this value at some untested locations. Where fills are being placed over the existing approach embankments, organic materials and loose or soft soils should be removed to expose the existing fill and, as a minimum, the existing fill should be removed to the new subgrade level.

After removal of the required materials, the exposed soil surface should be re-graded, compacted, and tested (proof rolled) with a loaded tandem truck or large vibratory roller under the supervision of qualified geotechnical personnel prior to fill placement. Any soft areas or yielding material within the subgrade should be removed and replaced with approved fill.

Lean clay was encountered in test pits TP08 and TP09, at the south end of the proposed realignment. At locations where the subgrade is comprised of clay, or where the presence of clay below the subgrade is thought to be influencing the subgrade performance based on the results of a proof roll, the subgrade should be over-excavated by 450 mm and reinstated using engineered rock fill or structural fill. A geotextile filter fabric will be required where coarse-grained fill is placed over fine-grained material.

5.2 EXCAVATIONS IN SOIL

The depths of excavations required depend on the existing grades on the site and the final elevation of the foundation elements (e.g. pile caps). As the pile caps are expected to be founded above the level of the brook, open excavations will be possible. Relatively shallow excavations below the ordinary high-water mark (elev. +1.03 m) may be required to allow placement of the armour stone as shown on the conceptual drawing package provided by HEC

During temporary excavations, side slopes should be no steeper than 1.5H:1V, should follow all applicable safety regulations, and should be frequently monitored for any indication of instability.

5.3 EXCAVATIONS IN ROCK

Shallow bedrock was encountered in test pits TP07 to TP09 which were advanced along the south approach. Bedrock outcrops are frequent in this area and there is an existing rock cut east of the road. As the road is being re-aligned to the east, additional rock cuts will be required to meet the design grades. The existing cut is supported by rock anchors. Rock excavation should proceed with consideration given to the anchors and the bedrock supported by the anchors. Anchors should be removed in a sequence that does not result in uncontrolled rock falls.

Based on a review of the outcropping, the bedrock has a prominent set of joints that have a strike roughly parallel with the road and a dip of approximately 45 degrees. Excavation into this rock should follow the fracturing in the rock so that this set of joints does not “daylight” on the face of the cut slopes. Therefore, without additional support (e.g. rock anchors) the cut slopes should be about 1H:1V but will depend on the specifics of the jointing. The slopes should be assessed by qualified geotechnical or geological personnel during construction to determine if additional excavation or anchoring is appropriate.

A rockfall catchment area should be designed to prevent or limit rockfall originating from the slope above the highway from reaching the highway lanes. Design of catchment area should include the ditch height and width and take into consideration the height of the slope, the steepness of the slope, the type and quality of the bedrock, as well as any other slope stabilization measures used.

If steeper slopes than those dictated by the joint orientation are preferred, the excavation can be supported by a series of rock anchors

Care should be taken during blasting operations to limit the amount of overbreak as the excavated slope should follow intact rock along the existing joints. If blasting damages the rock below the intended surface, additional excavation may be required to ensure the rock cut is stable.

5.4 WATER CONTROL

Good construction practices include diverting surface water away from excavations. This may be accomplished through the use of ditches and swales. The base of excavations should be shaped to drain to one or more sumps and pumped, as required. Any water discharged from site should meet all applicable regulatory requirements including those related to erosion and sedimentation control.

A plan for water control should be developed prior to the start of construction and the plan should be reviewed and adapted, as required, during all stages of construction. Given the proposed design and our understanding of the likely construction phasing, steel sheet pile cofferdams will likely not be required but sand bags or other water diversion techniques may be used to control relatively shallow water and allow for shallow excavations near or below the river level, where required.

5.5 STRUCTURAL FILL

Structural fill should be used below the pile caps to achieve the proposed subgrade elevations. Structural fill should consist of well-graded rock fill with a maximum particle size of 200 mm and a fines content less than 12 percent. Granular “B” or Granular “C” as specified by the Government

of Newfoundland and Labrador's Department of Transportation and Works Specifications Book are examples of suitable materials.

Where placed, structural fill should extend through the full extent of the fills in front of and transversely from the pile cap. Structural fill should extend behind the abutments a distance beyond the outside edge to include a structural splay of 1H:1V (the extents of the zone of influence beneath the pile cap). If fill is placed below the pile caps before the approach fills are placed, shallower slopes will be required to ensure stable slopes during construction (i.e. 1H:1V slopes will not have a sufficient factor of safety against slope instability).

Structural fill should be compacted to 100 percent of the standard Proctor maximum dry density as determined by *ASTM D698 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort*. For Materials where Proctor densities are not applicable, such as coarse rock fills, material should be compacted to a relative density of at least 80 percent. All structural fill should be placed at a water content that allows compaction to the specified density.

Appropriate lift thicknesses for structural fill will vary with the compaction equipment and material used. Typically, a rolling pattern of about six slow passes with a 10-ton vibrating roller would be required for a 300 to 500 mm lift. Placement of structural fill should be monitored by experienced geotechnical personnel to ensure that the required density is achieved.

5.6 APPROACH FILL

Portions of the site soils (inorganic material from above the groundwater level at a water content that allows for compaction to the requirements below) or imported select granular fill would be a suitable option to construct the approach fills. All, approach fill should be compacted to at least 95 percent of the standard Proctor maximum dry density and the upper 1.5 m below the subgrade should be compacted to a minimum of 100 percent. To ensure compaction through the entire depth of the lift, fill should be placed in lifts compatible with the compaction equipment used.

Due to realignment and widening of the approaches, the finished grade will be raised above the existing ground surface at some locations. Settlement analyses were completed assuming that the new embankments would be constructed of well-compacted granular borrow to heights of 5 to 7 m above existing grades. It is anticipated that the underlying native soil deposits will settle approximately 50 to 75 mm due to construction of these embankments. The majority of the induced settlement would occur during and immediately following placement of the fills. It is not anticipated that substantial long-term settlements due to consolidation or creep of the underlying soils would occur at this site.

Armour stone shall be placed in areas where fills will be subject to flowing water from the brook or wave-action from the East Arm. This armour stone should be designed to withstand the velocities anticipated in the brook during high flow periods and the most aggressive anticipated conditions in the East Arm.

5.7 SLOPE STABILITY

Slope stability analyses were performed based on the conditions encountered in the investigation to assess the stability of the proposed embankments. It was assumed that new embankments would be constructed of well compacted granular borrow to heights of 5 to 7 meters above existing grades. In order to achieve the required factors of safety for global stability the embankment slopes should be constructed no steeper than 2H:1V.

Where steeper slopes are required, permanent slopes as steep as 1.5H:1V may be practical provided an appropriately-sized thickness of angular well-graded rock fill or other stabilization measures are used.

5.8 FOUNDATIONS

Based on our geotechnical investigation and our understanding of the proposed design, we are providing recommendations for both driven and drilled piles founded in bedrock. However, due to the presence of numerous cobbles and boulders in the site soils, which may interfere with installation of driven piles, piles drilled into bedrock and driven to refusal are the recommended option to support the bridge abutments.

5.8.1 General

The design depth of frost penetration should be taken as 1.8 m. The bottom of footings in frost susceptible soils should be located below this depth to prevent heave under frost action. Where this depth is not maintained, an equivalent combination of soil and insulation, or other measures such as excavation and replacement with non-frost susceptible soil, may be used to protect the structure from frost action.

Base preparation for the pile cap should include removal of all rootmat, topsoil, and other deleterious materials (soft soils, organic material, etc.) down to the existing fill layer or native undisturbed soil.

5.8.2 Driven Pile Foundations

Steel H-Piles or open-ended pipe piles driven to practical refusal in bedrock are another option to support the bridge abutments. However, cobbles and boulders noted through the site soils may provide obstacles complicating their installation. The presence of cobbles and boulders can result in problems with shallow refusal, problems driving the piles plumb and on the correct alignment, problems achieving 'fixity', and damage during pile driving. If driven piles are to be used, consideration should be given to pre-drilling the pile locations to remove the obstructions and then seating the piles to the refusal criteria.

Notwithstanding the above, driven piles founded in bedrock may be designed using a ULS geotechnical axial compressive resistance of 80 MPa based on the cross-sectional area of the steel. The factored compressive axial resistances of several H-pile sections are provided in Table 13; we would be pleased to review other sections upon your request. In accordance with the Canadian Highway Bridge Design Code (CAN/CSA S6-14, 2014) Clause 6.9.1 this includes a resistance factor of 0.4.

Table 13 Factored Axial Resistance at ULS for Driven Piles

Pile Type	Factored Axial Resistance (Compression)
406 x 12.7 Steel Pipe Pile	1255 kN
HP 310 x 110	1120 kN
HP 360 x 152	1550 kN

The resistance will be achieved through a combination of end-bearing and shaft resistance. To achieve this resistance, the piles should penetrate the overburden and may also penetrate approximately to 1 to 3 m into bedrock. Precise estimates of pile penetration are not possible; the

above estimate is based on our past experience for sites with similar subsurface conditions under typical driving conditions.

The resistance of pile groups may be calculated as the sum of the individual pile capacities provided that the centre-to-centre spacing of the piles is at least three pile diameters. The expected settlement of piles driven to refusal on or in bedrock at the serviceability limit state (SLS) loads is negligible.

Piles should be driven with a hammer having a minimum rated energy of 450 Joules/cm² of steel cross-sectional area. Practical refusal in bedrock should be taken as a pile penetration of less than 25 mm for 15 blows at the rated energy for four consecutive 25-mm increments. The contractor should provide full details on the method of installation and equipment to the geotechnical engineer prior to starting the work.

If piles are obstructed by cobbles or boulders before reaching bedrock, remedial measures (e.g. excavating the obstruction, removing the pile and driving at a modified location, pre-drilling the pile locations, or using drilled piles) may be required. Alternatively, dynamic pile monitoring can be performed to assess the pile resistance and the piles analyzed by the structural and geotechnical engineers to assess if the pile group will meet other performance requirements (e.g. performance under lateral loads or in tension).

For driven piles, dynamic pile monitoring (e.g. using Pile Driving Analyzer System) should be carried out on the initial pile installations to verify that overstressing does not occur, that the hammer is operating within normal efficiencies, and that the estimated resistance provided for design is achieved at the set criteria. As a minimum, dynamic pile monitoring should be performed on 10 percent of the piles at end of initial drive and at the beginning of re-strike at each abutment. Full-time inspection by qualified geotechnical personnel is recommended during pile installation.

To further evaluate the potential for relaxation to occur following initial driving, at least two piles at each abutment should be re-tapped a minimum of 24 hours after initial driving refusal. If relaxation occurs, all piles should be re-driven to the refusal criteria and the cycle repeated until the refusal criteria is maintained during subsequent re-taps. If significant relaxation continues to occur, dynamic pile monitoring could be used to determine if the required load capacity is being developed.

5.8.3 Drilled Pile Foundations

Rock-socketed piles rely on the bond between the grout and the rock to develop their capacity. Design of rock-socketed piles should be based on the factored resistance of the socket which is a function of the socket diameter, socket length, bond stress, and installation method. Based on the types and quality of bedrock encountered at the site during our investigation, the following factored bond stresses are recommended for use in design of gravity-grouted rock sockets:

- Axial Compression 600 kPa
- Axial Tension 450 kPa

These values include a resistance factor of 0.4 for piles in compression and 0.3 for piles in tension in accordance with the Canadian Highway Bridge Design (CAN/CSA S6-14, 2014). The design bond length should begin below the highly-fractured or weak bedrock that occurs near the bedrock surface. For this site, we recommend that the design bond length not include the upper 1.5 m of

bedrock. Steel casing should be extended to the top of the bonded zone. Socket lengths should generally be kept between 3.0 m and 8.0 m.

As indicated above, rock-socketed piles provide capacity in tension that can be used to resist uplift forces. The uplift resistance should also consider pulling a cone or wedge of rock and soil. For design, the cone can be taken as a 60-degree apex from the base of the socket. If a series of piles are used, the uplift may mobilize a wedge of rock and soil which splays outwards from the base of the piles at 30 degrees. Submerged unit weights should be used for soils and rock below the groundwater table. A resistance factor of 0.8 is typically applied to the submerged unit weight.

For drilled piles socketed into bedrock, the factored geotechnical axial compressive resistance at ultimate limit states (ULS) is presented below in Table 14 for varying socket diameters and lengths. Group capacities for piles can be taken as the sum of the individual pile capacities provided that the centre-to-centre spacing between the bond zones of adjacent piles is at least three pile diameters. The settlement at the serviceability limit state (SLS) of socketed piles installed as described herein is expected to be negligible.

Table 14 Factored Socket Resistance at ULS for Drilled Piles in Bedrock

Socket Length	Pile Diameter			
	203 mm	254 mm	305 mm	457 mm
	Factored Axial Resistance, kN (Compression)			
5 m	1910	2390	2870	4300
6 m	2290	2870	3440	5170
7 m	2680	3350	4020	6030
8 m	3060	3830	4590	6890

Grouting should be performed promptly after drilling of the pile socket is complete. Installation of the piles should be closely monitored by personnel having experience with rock-socketed piles. Comparison of bedrock elevations should be carried out on an ongoing basis to check that the socket length is as designed. Compressive strength testing of grout used in the socket and pile shaft should also be completed.

In order to confirm the bond stress and the contractor's installation methods, we recommend verification testing be performed on at least one pile at each foundation location. Verification testing may be either carried out on a sacrificial pile installed specifically for the test or on a production pile. The test load should be at least two times the design load. If verification testing is performed on a production pile, the pile should be designed with a structural capacity at least 1.25 times the maximum test load and it should not be failed or overloaded during testing. Good practice dictates that a plan should be developed prior to testing to replace the pile in the case that it does fail during testing.

5.8.4 Lateral Pile Behaviour

For consideration of lateral loads, the depth to fixity for three piles types through newly placed approach, structural fill, or existing sand and gravel materials are provided below in Table 15.

Table 15 Depth to Fixity

Pile Type	Depth to Fixity (m)	
	Strong Axis (X-X)	Weak Axis (Y-Y)
406 x 12.7 Steel Pipe Pile	2.6	
HP 310 x 110	2.5	2.0
HP 360 x 152	2.8	2.3

5.9 BACKFILL

The abutments for the new bridge and retaining walls should be backfilled with a non-frost susceptible, non-expansive, non-corrosive, free-draining, well-graded material such as Granular 'C'. The extent of the granular backfill should be in accordance with the wall design requirements.

It is important that retaining walls are designed to ensure thorough drainage of the backfill material. This may be accomplished with a drainage system such as a longitudinal drain pipe discharging to a positive outlet. When backfilling behind a retaining wall, fill should be placed in lifts and compacted as a minimum to 95 percent of the standard Proctor maximum dry density. Where wall backfill acts as the road subgrade the compaction requirements for the approach fill may govern (i.e. the upper 1.5 m should be compacted to 100 percent of the standard Proctor maximum dry density). Care should be taken not to damage walls when performing backfilling and compaction operations. To limit compaction-induced stresses, compaction within 1.5 m of retaining structures should be performed with a walk-behind vibratory plate tamper or other lightweight compaction equipment in lieu of a vibratory drum roller.

All drainage materials, including backfill and drainage blankets, must be designed to limit loss of soil according to filter criteria.

The values for the soil parameters presented in the following section may be used for design of retaining walls. The earth pressure coefficients used for design should be selected or adjusted based on the appropriate finished back-slope angle. Walls that can tolerate little or no movement should be designed for at-rest lateral earth pressures.

5.10 PAVEMENT DESIGN

Based on the existing soil conditions, proposed approach fills, and expected traffic loadings, the following pavement structure is recommended:

Table 16 Pavement Structure

Materials	Pavement Structure
Asphalt Top	50 mm
Asphalt Base	60 mm
Granular "A"	150 mm
Granular "B"	450 mm

The pavement design is based on the subgrade soils being in a stable condition at the time the granular materials are placed. The subgrade soils may become soft and constructability can be a problem. As discussed above, where the subgrade is comprised of clay or where the presence of clay below the subgrade is influencing the subgrade performance, the subgrade should be over-excavated by 400 mm and reinstated using engineered rock fill or structural fill.

The physical properties and placing of the asphaltic courses, granular 'A', and granular 'B' should be in accordance with the most recent version of Newfoundland and Labrador Department of Transportation and Works Specifications Book.

5.11 GEOTECHNICAL PARAMETERS

The following unfactored values (Table 16) for the indicated parameters may be used for design purposes:

Table 17 Unfactored Geotechnical Parameters

Parameter	Value			
	In-Situ or Compacted Site Sand and Gravel	Compacted Granular "C" (a) (b)	In-Situ Silty Sand /Silty Gravel	Quartzose Sandstone Bedrock
Effective Angle of Internal Friction, degrees	34	36	32	-
Effective Cohesion, kPa	0	0	0	-
Total Unit Weight, kN/m ³	20.5	22	21.5	25.5
Submerged Unit Weight ^(c) , kN/m ³	10.5	12	11.5	15.5
Coefficient of Active Earth Pressure ^(d)	0.28	0.26	0.31	-
Coefficient of Passive Earth Pressure ^(d)	3.54	3.85	3.25	-
Coefficient of At-Rest Earth Pressure ^(d)	0.44	0.41	0.47	-
Friction Factor, Soil/Concrete Interface ^(e)	0.45	0.50	0.38	-

(a) Compacted material shall be placed in lifts and suitably compacted as described above.

(b) As per Government of Newfoundland and Labrador Department of Transportation and Works Specifications Book (2011).

(c) For uplift design the groundwater table should be assumed at the ground surface and submerged unit weights should be used.

(d) Coefficients of earth pressure presented in the table assume a frictionless wall with a vertical back face and a horizontal back slope.

(e) For mass concrete or masonry, lower values will be required for formed or pre-cast concrete.

5.12 WINTER WEATHER CONDITIONS

Where practical, earthwork during freezing temperatures should be avoided. In the event of winter construction, special measures will be required to ensure that fills and foundations are not placed on frozen ground and that the soils are protected from freezing after placement. Even following careful procedures and precautions experience has shown that earthworks in these types of soils often become impractical at temperatures below approximately -5°C.

5.13 SEISMIC SITE CLASSIFICATION

Based on the findings at the test locations, the site classification for seismic site response in accordance with Clause 4.4.3.2 of the Canadian Highway Bridge Design Code (CAN/CSA-S6-14, 2014) is Seismic Site Class D (stiff soil).

6.0 CLOSURE

This report has been prepared to assist in the design and construction of the proposed Rocky Barachois Bridge. This report has been prepared for the sole benefit of Harbourside Engineering consultants and their agents. Any use which a third party makes of this report is the responsibility of such third party.

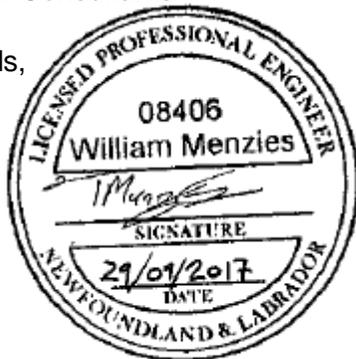
The recommendations made in this report are in accordance with our present understanding of your project. If any details are included in the final design of the proposed structure that differ from the assumptions outlined in this report, the geotechnical engineer should be consulted.

This report is based on the site conditions encountered by Harbourside Geotechnical Consultants at the time of the work at the specific sampling locations, and can only be extrapolated to a limited extent around these locations. Should any conditions differ from those detailed on the borehole records, the engineer should be notified to allow reassessment of any design assumptions.

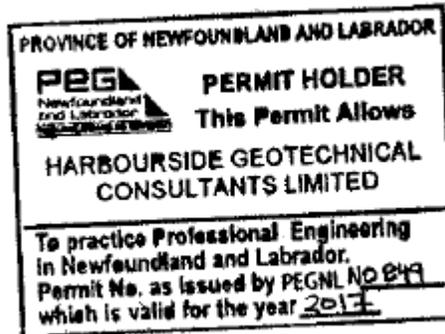
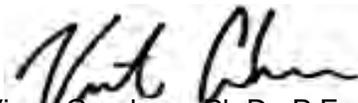
If you have any questions or require any additional information, please do not hesitate to contact the undersigned at your convenience.

Harbourside
Geotechnical Consultants

Kind Regards,



W. Todd Menzies, M.A.Sc., P.Eng.
Principal, Geotechnical Engineer
Office: (902) 405-4696
tmenzies@harboursideengineering.ca

Vince Goreham, Ph.D., P.Eng.
Principal, Geotechnical Engineer
Office: (902) 405-4696
vgoreham@harboursideengineering.ca

APPENDIX A

Symbols and Terms Used on Borehole and Test Pit Records

Borehole Records BH01 to BH07

Test Pit Records TP01 to TP04 and TP06 to TP09

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:

USCS SOIL CLASSIFICATION SYMBOLS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN 75 µm SIEVE SIZE	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON 4.75 mm SIEVE	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES. LITTLE OR NO FINES
				GM	SILTY GRAVELS, GRAVEL – SAND – SILT MIXTURES
		SANDS MORE THAN 50% OF COARSE FRACTION PASSING THE 4.75 mm SIEVE	CLEAN SANDS		GC
	SANDS WITH FINES			SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
				SM	SILTY SANDS, SAND – SILT MIXTURES
	FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN 75 µm SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		SC
				ML	INORGANIC SILTS
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY
SILTS AND CLAYS		LIQUID LIMIT GREATER THAN 50		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
				MH	INORGANIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

OTHER COMMONLY USED SYMBOLS

GLACIAL TILL		UNSTRATIFIED GLACIAL DEPOSIT RANGING FROM CLAY TO BOULDERS
BEDROCK		IGNEOUS BEDROCK
		METAMORPHIC BEDROCK
		SEDIMENTARY BEDROCK
MATERIALS PLACED BY HUMANS		FILL: SUBSURFACE MATERIALS IDENTIFIED AS PLACED BY HUMANS
		ASPHALT
		CONCRETE

SAMPLE TYPE

SS	Split Spoon (obtained by performing SPT)
ST	Shelby Tube (Thin-Walled Tube)
BS	Bulk Sample
PS	Piston Sample
WS	Wash Sample
HQ, NQ, AQ, BQ, etc.	Rock Core Samples Obtained Using Standard Size Diamond Bits

SPT N-VALUE (N-INDEX)

The standard penetration test (SPT) provides a qualitative evaluation of compactness and a qualitative comparison of subsoil stratification. The SPT is performed in the bottom of a borehole where a split-barrel sampler having an outside diameter of 50.8 mm is impacted using a hammer weighing 623 N falling 0.76 m for each hammer blow. The SPT N-value is the blow count representation of the penetration resistance of the soil. In accordance with ASTM D1586, the N-value, reported in blows per 300 mm, equals the sum of the number of blows (N) required to drive the sampler over the depth interval of 150 to 450 mm. However, when a 600 mm sampler is used the number of blows (N) required to drive the sampler over the interval of 300 to 600 mm may be reported if this value is lower. For samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in mm (e.g. 50/120). Although some methods make use of N-values corrected for various factors (for equipment used, overburden stress, length of drill rod, etc.) no corrections have been applied to the N-values presented on the logs.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests (DCPT) are performed using a standard 60-degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the SPT test. The DCPT value is the number of blows of the hammer required to drive the cone 300 mm. The DCPT provides a qualitative evaluation of compactness and allows for a qualitative comparison of subsurface stratification.

RECOVERY

For soil samples, recovery is recorded as the total length of the soil sample recovered. For rock core, recovery is expressed as a percentage of the total length drilled on a per run basis.

OTHER TESTS

S	Sieve Analysis	CD	Consolidated-Drained Triaxial	C	Consolidation
H	Hydrometer Analysis	CU	Consolidated-Undrained Triaxial	Q _u	Unconfined Compression
γ	Unit Weight	UU	Unconsolidated Undrained Triaxial	I _p	Point Load Index, I _p (50)
G _s	Specific Gravity of Soil Particles	DS	Direct Shear	k	Laboratory Permeability

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	Vegetation, roots, and moss with organic matter and topsoil typically forming a mattress at the ground surface.
Topsoil	Mixture of soil and humus capable of supporting vegetative growth.
Peat	A soil composed of vegetable tissue in various stages of decomposition usually with an organic odor, a dark-brown to black color, a spongy consistency, and a texture ranging from fibrous to amorphous.
Till	Non-stratified glacial deposit which may range from clay to boulders
Fill	Artificial (man-made) deposits transported and placed on the natural surface of soil or rock.

Terminology describing soil structure:

Homogeneous	The lack of visible bedding and the same appearance and colour throughout
Desiccated	Having visible signs of weathering by oxidation of clay minerals, shrinking cracks, etc.
Fissured	Having cracks and hence a blocky structure
Stratified	Composed of regular alternating successions of different soil types
Varved	Comprised of regular alternating successions of silt and clay which were transported into freshwater lakes by melt water
Layer	> 75 mm
Seam	2 mm to 75 mm
Parting	< 2 mm
Pocket	Small erratic deposit, usually less than 300 mm
Lens	Lenticular deposit

Terminology describing soil types:

Soils are described in accordance with the Unified Soil Classification System (USCS) as described in ASTM D2487 and ASTM D2488. This system classifies soil into categories representing the results of laboratory tests to determine the particle-size characteristics, the liquid limit, and the plasticity index. Using this system, soils are assigned a group name (e.g. silty sand) and symbol (e.g. SM). The various groupings of this classification system have been devised to correlate in a general way with the engineering behavior of soils. Laboratory tests are performed on the portion of the sample passing the 75 mm sieve.

When laboratory test results indicate that the soil is close to another classification group, the borderline condition can be indicated with two symbols separated by a slash (e.g. CL/CH).

Terminology describing cobbles, boulders, and non-matrix materials:

Materials outside of the USCS (e.g. particles larger than 75 mm, organic matter, construction debris) are described based on the proportion of these materials by weight using the following terminology:

Trace, or occasional	< 10%
Some	10% to 20%
Frequent	> 20%

Terminology describing the compactness condition of cohesionless soils:

A qualitative term describing the compactness condition of a cohesionless soil is interpreted from the SPT N-value (also known as the N-index). The relationship between the SPT N-value and the compactness condition is shown in the following table.

Compactness Condition	SPT N-Value (blows per 0.3 m)
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Over 50

Terminology describing the compactness condition of cohesive soils:

Cohesive soils can be classified in relation to undrained strength. Undrained strength can be determined by a number of tests including: unconfined compression tests, field and laboratory vane tests, laboratory fall-cone tests, shear-box tests, and triaxial tests. The consistency and undrained shear strength may also be approximately related the SPT N-Value. The relationship between the consistency and the undrained shear strength, as well as a rough correlation with SPT N-Value as shown in the following table.

Consistency	Undrained Shear Strength (kPa)	SPT N-Value (blows per 0.3 m)
Very Soft	< 12	< 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	> 200	> 30

ROCK DESCRIPTION

Rock is a natural aggregate of minerals that cannot be readily broken by hand and that will not disintegrate on a first wetting and drying cycle. A rockmass comprises blocks of intact rock that are separated by discontinuities such as cleavage, bedding planes, joints, shears and faults.

Terminology Describing Geological Classification of Rock:

Rock is classified with respect to its geological origin or lithology as follows:

Igneous Rocks	Rocks such as granite, diorite, and basalt, which are formed by the solidification of molten material.
Sedimentary Rocks	Rocks such as sandstone, limestone and shale, which are formed by the lithification of sedimentary soils.
Metamorphic Rocks	Rocks such as quartzite, schist, and gneiss, which have been altered by the application of intense heat and/or pressure.

Terminology Describing the Strength of Intact Rock:

Strength is the maximum stress level that can be carried by a specimen. Rocks may be classified based on their intact strength as shown in the following table.

Term	Unconfined Compressive Strength (MPa)
Extremely Weak	0.25 to 1
Very Weak	1 to 5
Weak	5 to 25
Medium Strong	25 to 50
Strong	50 to 100
Very Strong	100 to 250
Extremely Strong	> 250

Terminology Describing Discontinuity Spacing

The structural integrity of a rockmass will be affected by the presence of discontinuities. The spacing of discontinuities can vary from extremely wide to extremely close as indicated in the table below.

Term	Spacing Width (m)
Extremely Close	< 0.02
Very Close	0.02 to 0.06
Close	0.06 to 0.20
Moderately Close	0.20 to 0.6
Wide	0.6 to 2.0
Very Wide	2.0 to 6.0
Extremely Wide	> 6.0

Rock Quality Designation (RQD)

RQD is an indirect measure of the number of fractures within a rockmass. The method provides a quick and objective technique to estimate rockmass quality during diamond drill core logging. All pieces of intact and sound rock greater than 100 mm long are summed and divided by the total length of the core run in accordance with ASTM D6032.

RQD Classification	RQD (%)
Very Poor Quality	0 to 25
Poor Quality	25 to 50
Fair Quality	50 to 75
Good Quality	75 to 90
Excellent Quality	90 to 100

Terminology to Describe Rock Weathering

The state of weathering significantly alters the geotechnical behaviour of rocks and rockmasses. Weathering of the rockmass may be classified as shown in the following table.

Term	Description
Fresh	No visible sign of rock material weathering; perhaps slight discolouration on major discontinuity surfaces.
Slightly Weathered	Discolouration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discoloured by weathering and may be somewhat weaker than its fresh condition.
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones
Highly Weathered	More than a half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones.
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 17/09/2016 TO 20/09/2016 WATER LEVEL 22/09/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm)	BLOWS / 150 mm (N VALUE)	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
6.86	6.73	ASPHALT																
	5.95	FILL: grey gravel with silt and sand to sand with silt and gravel			SS	1	450	17-20-17-13 (30)	S									
1		FILL: brown to grey sand with silt and gravel - with occasional cobbles and boulders			SS	2	300	12-10-9-10 (19)	S									
2					SS	3	150	5-8-7-7 (14)										
3					SS	4	150	17-17-50 / 125 mm										
4					SS	5	0	13-9-4-6 (10)										
5					SS	6	75	7-12-12-9 (21)										
6					SS	7	200	76-mm Spoon										
6	0.76	Compact to very dense brown to grey SAND with silt and gravel to GRAVEL with silt and sand (Alluvium) - with occasional cobbles and boulders			SS	8	75	10-8-7-8 (15)	S									
7					SS	9	75	7-5-5-9 (10)										
8					SS	10	175	76-mm Spoon										
9					SS	11	200	12-15-13-19 (28)										
10					SS	12	200	76-mm Spoon										
11					SS	13	175	17-37-25-44 (62)										
12					SS	14	0	20-28-15-12 (27)										
13					SS	15	125	12-11-6-8 (14)										

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

BH 01



BOREHOLE RECORD

CLIENT HARBORSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 17/09/2016 TO 20/09/2016 WATER LEVEL 22/09/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm)	BLOWS / 150 mm (N VALUE)	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m								
										W _p	W	W _L						
													*					
													●					
										0	10	20	30	40	50	60	70	80
11		Compact to very dense brown to grey SAND with silt and gravel to GRAVEL with silt and sand (Alluvium) - with occasional cobbles and boulders (continued)			SS	16	200	20-14-14-12 (26)	S									
					SS	17	150	11-17-19-23 (36)										
					SS	18	100	37-55-50 / 75 mm										
		- 450 mm boulder																
					SS	19	75	20-43-50 / 50 mm										
					SS	20	100	21-15-17-8 (25)										
					SS	21	250	20-19-20-23 (39)										
					SS	22	150	12-16-34-27 (50)										
					SS	23	50	20-28-26-28 (54)										
	-8.58	Compact brown silty SAND			SS	24	300	12-13-13-12 (25)	S									
					SS	25	0	12-15-14-15 (29)										
	-10.13	Compact to dense brown to grey well graded SAND with silt and gravel to GRAVEL with silt and sand - with occasional cobbles and boulders			SS	26	150	15-19-22-29 (41)										
					SS	27	0	40-17-18-21 (35)										
					SS	28	300	17-21-15-13 (28)	S									
								22-20-19-										

HARBORSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



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BH 01

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 17/09/2016 TO 20/09/2016 WATER LEVEL 22/09/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm)	BLOWS / 150 mm (N VALUE)	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa										
										0	10	20	30	40	50	60	70	80		
21	-14.55	Compact to dense brown to grey well graded SAND with silt and gravel to GRAVEL with silt and sand - with occasional cobbles and boulders (continued)			SS	29	50	18 (37)												
					SS	30	50	19-43-18-33 (51)												
22		End of borehole - 25-mm diameter standpipe installed																		
23																				
24																				
25																				
26																				
27																				
28																				
29																				

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 21/09/2016 TO 22/09/2016 WATER LEVEL N/A BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm)	BLOWS / 150 mm (N VALUE)	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
7.70	7.57	ASPHALT																
		FILL: brownish-grey silty sand with gravel			SS	1	350	22-18-16-22 (34)	S									
	6.48	FILL: brown to grey silty sand with gravel - with occasional cobbles and boulders			SS	2	175	8-4-16-17 (20)										
					SS	3	150	9-15-8-17 (23)										
					SS	4	0	7-8-16-6 (22)										
					SS	5	50	7-6-7-6 (13)										
					SS	6	75	4-6-8-6 (14)										
					SS	7	75	27-6-6-7 (12)										
	0.13	Compact to dense grey to brown GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders			SS	8	0	6-10-15-11 (25)										
		- occasional wood fragments at a depth of 8.5 m			SS	9	200	9-11-22-27 (33)	S									
					SS	10	200	20-32-18-22 (40)	S									
								15-26-18-										

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



BOREHOLE RECORD

BH 02

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 21/09/2016 TO 22/09/2016 WATER LEVEL N/A BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm)	BLOWS / 150 mm (N VALUE)	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa					
										20	40	60	80		
		Compact to dense grey to brown GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders (continued)			SS	11	250	20 (38)							
				SS	12	25	34-50 / 25 mm								
				SS	13	150	8-14-11- 12 (23)								
				SS	14	100	31-20-14- 10 (24)								
				SS	15	75	17-26-60 / 125 mm								
				SS	16	0	50 / 25 mm								
				End of borehole											
	-9.06														

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



BOREHOLE RECORD

CLIENT HARBORSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 27/11/2016 TO 28/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
2.17		FILL: brown silty sand with gravel (drill access pad) - with frequent grubbings			SS	1	50	1-1-1-2 (2)										
0.95		Compact grey to brown GRAVEL with silt and sand (Alluvium)			SS	2	175	9-6-5-5 (10)										
					SS	3	50	6-7-4-6 (10)										
-0.88		- 325 mm boulder Compact brown GRAVEL with silt and sand to SAND with silt and gravel (Alluvium)			SS	4	175	10-15-11-12 (23)										
					SS	5	200	14-12-9-10 (19)	S									
					SS	6	50	5-5-10-6 (15)										
					SS	7	100	6-6-12-14 (18)										
-3.62		Compact brown to grey SILTY SAND to GRAVEL with silt and sand (Alluvium)			SS	8	100	8-15-11-10 (21)										
					SS	9	0	14-14-10-8 (18)										
					SS	10	150	76-mm Spoon	S									
					SS	11	50	9-10-11-12 (21)										
					SS	12	75	76-mm Spoon										
					SS	13	150	9-9-7-7 (14)										

HARBORSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 27/11/2016 TO 28/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) RQD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa									
										20	40	60	80						
	-8.24	Compact brown to grey SILTY SAND to GRAVEL with silt and sand (Alluvium) <i>(continued)</i>																	
	-11	Dense brown to grey GRAVEL with silt and sand - with frequent cobbles and boulders			SS	14	150	16-13-22-21 (35)											
	-12	- 800 mm boulder																	
	-13				SS	15	175	10-7-50 / 125 mm											
	-14	- 425 mm boulder																	
	-15				SS	16	200	22-26-23-50 / 50 mm											
	-13.22	Dense yellowish-brown to light grey SILTY SAND - partially cemented			SS	17	200	19-25-33-19 (52)											
	-16																		
	-17				SS	18	375	21-26-19-25 (44)	S										
	-15.81	Very poor quality white to light purple QUARTZOSE SANDSTONE - strong to very strong - slightly to moderately weathered			GB	19	550	N/A											
					SS	20	150	44-50 / 0 mm											
					HQ	21	100%	0%											
					HQ	22	100%	0%											

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 28/11/2016 TO 30/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
7.61	7.46	ASPHALT																
		FILL: greyish-brown sand with silt and gravel			SS	1	300	23-31-22-27 (49)	S									
1					SS	2	175	25-47-16-12 (28)										
6.11		FILL: brown sand with silt and gravel - with frequent cobbles and boulders			SS	3	200	23-33-50 / 100 mm										
2		- 350 mm boulder			SS	4	200	11-13-5-7 (12)										
3	4.59	FILL: grey gravel with sand - with occasional wood fragments			SS	5	75	7-8-50 / 75 mm										
4	4.03	FILL: brown gravel with silt and sand to sand with silt and gravel - with frequent cobbles and boulders			SS	6	75	6-8-14-6 (20)										
5					SS	7	25	8-6-4-4 (8)										
6					SS	8	75	5-4-4-4 (8)										
7					SS	9	50	4-4-10-8 (14)										
8					SS	10	100	5-5-7-8 (12)										
9					SS	11	25	76-mm Spoon										
	-0.77	ROOTMAT/TOPSOIL (Loose to compact brown to black silty sand with some organic material, roots, and rootlets)			SS	12	100	12-13-38-50 / 75 mm										
	-1.02	Compact to dense grey to brown GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders			SS	13	63	23-20-21-19 (40)										
					SS	14	350	13-37-24-22	S									

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

(Continued Next Page)



HARBOURSIDE
Geotechnical Consultants

BOREHOLE RECORD

BH 04

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 28/11/2016 TO 30/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa									
										20	40	60	80						
		Compact to dense grey to brown GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders (continued)						(46)											
11					SS	15	200	25-32-35-36 (67)											
12					SS	16	25	14-8-7-8 (15)											
13					SS	17	100	6-8-5-6 (11)											
14					SS	18	100	42-52-28-52 (80)											
15					SS	19	75	51-26-14-19 (33)											
16					SS	20	75	10-9-8-8 (16)											
17					SS	21	75	18-18-10-12 (22)											
18					SS	22	75	22-15-11-12 (23)											
19					SS	23	150	7-10-13-10 (23)											

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

(Continued Next Page)

BH 04



HARBOURSIDE
Geotechnical Consultants

BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 28/11/2016 TO 30/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa											
										20	40	60	80								
21	-13.63	Compact to dense grey to brown GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders (continued)																			
22		Compact to dense grey GRAVEL with silt and sand to SILTY SAND with gravel - with frequent cobbles and boulders		SS	24	225	7-10-7-7 (14)														
23				SS	25	300	24-18-19-14 (33)			S											
24		- 250 mm boulder																			
25				SS	26	200	34-48-125 / 125 mm														
26				SS	27	50	37-47-50 / 25 mm														
27																					
28																					
29	-21.04	Dense to very dense yellowish-brown SILTY SAND																			
	-21.70	Poor quality pink to light purple QUARTZOSE SANDSTONE - strong - moderately weathered																			
			SS	28	125	50 / 125 mm															
			NQ	29	89%	40%															

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

(Continued Next Page)

BH 04



HARBOURSIDE
Geotechnical Consultants

BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 28/11/2016 TO 30/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) RQD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa			
										20	40	60	80
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m			
										W _p	W	W _L	
										0 10 20 30 40 50 60 70 80			
-31		Poor quality pink to light purple QUARTZOSE SANDSTONE - strong - moderately weathered (continued)			NQ	30	100%	30%	Qu				
	-23.88												
-32	-24.37	Poor quality CONGLOMERATIC QUARTZOSE SANDSTONE - weak to medium strong - with secondary voids due to dissolution of carbonate minerals											
		End of borehole *25-mm diameter standpipe blocked at 0.5 m depth											
-33													
-34													
-35													
-36													
-37													
-38													
-39													



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 30/11/2016 TO 02/12/2016 WATER LEVEL 04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
7.53		ASPHALT																
7.35		FILL: dense greyish-brown sand with silt and gravel to silty sand with gravel			SS	A1	300	9-23-25-29 (48)										
		- 250 mm boulder			SS	A2	50	50 / 50 mm										
6.16		FILL: brown gravel with silt and sand to sand with silt and gravel - with frequent cobbles and boulders			SS	B1	75	7-7-12-19 (19)										
					SS	B2	150	9-11-7-12 (18)	S									
					SS	3	125	14-11-17-50 / 100 mm										
					SS	4	50	7-5-19-10 (24)										
					SS	5	50	6-9-10-11 (19)										
1.74		FILL: grey to brown gravel with silt and sand - with frequent cobbles and boulders			SS	6	100	12-36-23-9 (32)	S									
					SS	7	0	7-1-2-9 (3)										
					SS	8	0	10-14-8-26 (22)										
					SS	9	0	50 / 25 mm										
					SS	10	25	50 / 50 mm										
-1.10		Compact to dense brown to grey GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders			SS	11	200	17-22-20-14 (34)	S									

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

BH 05



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 30/11/2016 TO 02/12/2016 WATER LEVEL 04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m								
										W _p	W	W _L						
										○	●	★	●					
										0	10	20	30	40	50	60	70	80
11		Compact to dense brown to grey GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders (continued)			SS	12	175	8-16-16-15 (31)			○	●						
12						SS	13	125	17-17-11-10 (21)			●						
13						SS	14	150	6-7-7-9 (14)			○	●					
14		- 200 mm boulder				SS	15	25	50 / 125 mm									
14	-6.77																	
15		Compact brown SILTY SAND with gravel (Alluvium) - with frequent cobbles and boulders - 480 mm boulder - soft brown clay pocket at 15.3 m depth			SS	16	325	14-15-13-25 (28)	S		○	●						
16	-8.55																	
17		Compact greyish-brown to brown GRAVEL with sand to SAND with silt and gravel (Alluvium) - with occasional cobbles and boulders				SS	17	100	7-10-12-10 (22)			○	●					
18																		
19	-11.37	Compact brown SAND with silt to SILTY SAND (Alluvium) - with occasional gravel - with occasional cobbles and boulders			SS	18	125	21-13-13-22 (26)	S		○	●						
						SS	19	0	27-13-14-18				●					

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

(Continued Next Page)



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 30/11/2016 TO 02/12/2016 WATER LEVEL 04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa										
										20	40	60	80							
								(27)												
		Compact brown SAND with silt to SILTY SAND (Alluvium) - with occasional gravel - with occasional cobbles and boulders (continued)			SS	20	325	16-17-14-13 (27)												
	-14.05																			
		Dense to very dense greyish-brown to brownish-grey GRAVEL with silt and sand to SAND with silt and gravel - with frequent cobbles and boulders			SS	21	350	20-31-19-18 (37)	S											
					SS	22	100	19-37-48-50 / 75 mm												
	-17.39																			
		Very dense grey to greyish-brown SILTY GRAVEL with sand to SILTY SAND with gravel			SS	23	125	21-34-26-31 (57)	S											
					SS	24	125	26-52-35-57 (87)												
					SS	25	50													
	-21.46																			
					NQ	26	85%	22%												

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

BH 05



HARBOURSIDE
Geotechnical Consultants

BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 30/11/2016 TO 02/12/2016 WATER LEVEL 04/12/2016 BH SIZE HW/NW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa										
										0	10	20	30	40	50	60	70	80	W _p	W
31		Very poor to very good quality light purple to light brown QUARTZOSE SANDSTONE - slightly to moderately weathered - weak to medium strong - occasional secondary voids due to dissolution of minerals - staining on fractures (<i>continued</i>)			NQ	27	100%	34%	Qu	[Grid for shear strength and other tests]										
32		- strong to very strong below 32.0 m depth		NQ	28	100%	88%			[Grid for shear strength and other tests]										
33	-25.54	Poor quality light purple to pink QUARTZOSE SANDSTONE - slightly to moderately weathered - medium strong - staining on fractures		NQ	29	100%	25%			[Grid for shear strength and other tests]										
34		- clay seam at 34.3 m depth		NQ	30	100%	30%			[Grid for shear strength and other tests]										
36	-28.54	End of borehole - 25-mm diameter standpipe installed								[Grid for shear strength and other tests]										
37										[Grid for shear strength and other tests]										
38										[Grid for shear strength and other tests]										
39										[Grid for shear strength and other tests]										

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

BH 06



HARBOURSIDE
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BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 25/11/2016 TO 27/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa									
										20	40	60	80						
	6.85									WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m									
	6.70	ASPHALT																	
		FILL: grey gravel with silt and sand			SS	1	300	31-25-22-17 (39)	S										
1					SS	2	150	19-13-18-14 (31)											
	5.35	FILL: greyish-brown to brown gravel with silt and sand - with frequent cobbles and boulders			SS	3	150	8-6-5-9 (11)											
2					SS	4	100	17-20-16-19 (35)											
3					SS	5	50	4-7-8-26 (15)											
4					SS	6	0	9-13-6-4 (10)											
5					SS	7	25	36-44-11-11 (22)											
6					SS	8	0	26-50 / 75 mm											
7					SS	9	50	76-mm Spoon											
8					SS	10	100	9-10-12-23 (22)											
	-0.62	Compact to very dense brown to grey SAND with silt and gravel to GRAVEL with silt and sand (Alluvium) - with frequent cobbles and boulders			SS	11	200	76-mm Spoon	S										
8					SS	12	150	16-50 / 25 mm											
9					SS	13	200	76-mm Spoon											
		- 450 mm boulder			SS	14	150	6-10-50 / 75 mm											

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

(Continued Next Page)



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 25/11/2016 TO 27/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa										
										20	40	60	80							
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m										
										0	10	20	30	40	50	60	70	80		
11		Compact to very dense brown to grey SAND with silt and gravel to GRAVEL with silt and sand (Alluvium) - with frequent cobbles and boulders (continued)			SS	15	175	76-mm Spoon												
							SS	16	25	12-50 / 50 mm										
12							SS	17	75	15-25-14-15 (29)										
13							SS	18	175	12-14-14-11 (25)										
14							SS	19	25	48-25-29-50 / 75 mm										
15							SS	20	0	48-50 / 75 mm										
16							SS	21	150	6-12-13-17 (25)										
17							SS	22	200	13-11-27-1 (28)	S									
18							SS	23	100	23-21-15-16 (31)										
	-10.69			Dense to very dense grey GRAVEL with silt and sand to SAND with silt and gravel - with frequent cobbles and boulders			SS	24	75	50 / 75 mm										
19						SS	25	150	25-58-46-50 / 25 mm											
							SS	26	250	35-51-26-22	S									

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

BH 06



BOREHOLE RECORD

CLIENT HARBORSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 25/11/2016 TO 27/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa											
										20	40	60	80								
		Dense to very dense grey GRAVEL with silt and sand to SAND with silt and gravel - with frequent cobbles and boulders (continued)						(48)													
-21					SS	27	175	23-23-18-47 (41)													
-22																					
-23					SS	28	25	17-18-24-24 (42)													
					SS	29	25	50 / 50 mm N/A													
					HQ	30	450														
					HQ	31	275	N/A													
-24																					
		- 675 mm boulder			HQ	32	525	N/A													
-25																					
					HQ	33	75	N/A													
-26					SS	34	50	18-66-22-18 (40)													
	-19.69	Very poor to fair quality purple to purplish-grey QUARTZOSE SANDSTONE - medium strong to strong - moderately weathered - with staining on fractures			HQ	35	59%	0%													
-27					HQ	36	60%	50%													
					HQ	37	100%	45%													
					HQ	38	100%	57%													
					HQ	39	87%	0%													
-28																					
		- slightly weathered below 28.3 m depth - clay seam at 28.4 m depth - strong to very strong below 28.5m depth			HQ	40	95%	61%													
-29																					
	-22.74				HQ	41	100%	62%	Qu												

HARBORSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



HARBOURSIDE
Geotechnical Consultants

BOREHOLE RECORD

BH 06

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 25/11/2016 TO 27/11/2016 WATER LEVEL *04/12/2016 BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) RQD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa										
										20	40	60	80							
		End of borehole *25-mm diameter standpipe blocked at 6.0 m depth																		
31																				
32																				
33																				
34																				
35																				
36																				
37																				
38																				
39																				

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



BOREHOLE RECORD

CLIENT HARBORSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 02/12/2016 TO 05/12/2016 WATER LEVEL N/A BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa								
										20	40	60	80					
6.88	6.73	ASPHALT																
		FILL: grey gravel with silt and sand																
1					SS	1	200	14-33-16-14 (30)										
					SS	2	100	20-11-10-12 (21)										
2	4.90	FILL: brown to grey gravel with silt and sand - with frequent cobbles and boulders			SS	3	300	11-6-5-6 (11)										
3					SS	4	25	4-3-4-3 (7)										
4					SS	5	125	3-6-6-6 (12)										
5					SS	6	100	9-45-25-37 (62)										
6					SS	7	0	19-19-14-7 (21)										
7					SS	8	0	11-11-15-9 (24)										
8					SS	9	50	6-4-11-9 (15)										
8	-1.20	Compact to dense brown to grey GRAVEL with silt and sand to SAND with silt and gravel (Alluvium) - with frequent cobbles and boulders			SS	10	50	5-6-6-16 (12)										
					SS	11	300	27-29-23-22 (45)	S									
9					SS	12	50	14-16-11-9 (20)										
					SS	13	175	6-12-51-50 / 0 mm										

HARBORSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

BH 07



BOREHOLE RECORD

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 02/12/2016 TO 05/12/2016 WATER LEVEL N/A BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) ROD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa											
										20	40	60	80								
								(37)	S	WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m											
		Compact to dense brown to grey GRAVEL with silt and sand to SAND with silt and gravel - with occasional cobbles and boulders (continued)			SS	24	375	15-12-13-15 (25)													
						SS	25	125	14-16-15-15 (30)												
						SS	26	25	12-10-12-11 (22)												
						SS	27	50	12-17-18-20 (35)												
						SS	28	25	16-16-11-8 (19)												
						SS	29	175	19-20-19-21 (39)												
	-16.92	Compact to very dense grey SILTY SAND with gravel - with occasional cobbles and boulders																			
						SS	30	175	17-29-21-47 (50)	S											
						SS	31	150	16-16-16-11 (27)												
	-20.80	Very poor quality purple QUARTZOSE SANDSTONE - slightly to moderately weathered - medium strong to strong - staining on fractures																			
						HQ	32	99%	46%												
						HQ	33	82%	0%												
						HQ	34	60%	0%												
						HQ	35	67%	0%												
	-22.99				HQ	36	62%	0%													

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17

(Continued Next Page)



HARBOURSIDE
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BOREHOLE RECORD

BH 07

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: BORING 02/12/2016 TO 05/12/2016 WATER LEVEL N/A BH SIZE HW

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	REC. SOIL (mm) REC. ROCK (%)	BLOWS / 150 mm (N VALUE) RQD %	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa									
										20	40	60	80						
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m									
										W _p	W	W _L	*						
										●									
										0	10	20	30	40	50	60	70	80	
31		Poor to good quality light purple QUARTZOSE SANDSTONE - slightly weathered - strong to very strong - staining on fractures (<i>continued</i>)			HQ	37	100%	37%											
				HQ	38	93%	78%												
32				HQ	39	100%	61%	Qu											
33				HQ	40	100%	48%												
34	-27.66	End of borehole																	
35																			
36																			
37																			
38																			
39																			

HARBOURSIDE GEOTECHNICAL CONSULTANTS, BOREHOLE RECORD 29/09/17



HARBOURSIDE
Geotechnical Consultants

TEST PIT RECORD

TP01

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: DUG 27/11/2016 WATER LEVEL *27/11/2016

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa												
								0	10	20	30	40	50	60	70	80				
4.80	4.7	ROOTMAT/TOPSOIL																		
		FILL: brown gravel with silt and sand - abandoned steel culvert at 0.5 m depth																		
1	4.0	FILL: greyish-brown gravel with sand - with trace silt - with frequent cobbles and occasional boulders																		
2					GB	1	S													
3																				
4	1.1	End of test pit * no water infiltration observed while test pit was open																		
5																				
6																				
7																				
8																				
9																				

HARBOURSIDE GEOTECHNICAL CONSULTANTS, TEST PIT RECORD 29/09/17



HARBOURSIDE
Geotechnical Consultants

TEST PIT RECORD

TP03

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: DUG 27/11/2016 WATER LEVEL *27/11/2016

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa											
								20	40	60	80								
	5.50	ROOTMAT/TOPSOIL																	
	5.24	FILL: brown silty sand - with trace silt																	
	5.3	FILL: light brown gravel with sand - with trace silt and occasional cobbles and boulders																	
1																			
2					GB	1	S												
3																			
	2.3	End of test pit - practical limit of excavation * no water infiltration observed while test pit was open																	
4																			
5																			
6																			
7																			
8																			
9																			

HARBOURSIDE GEOTECHNICAL CONSULTANTS, TEST PIT RECORD 29/09/17



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TEST PIT RECORD

TP04

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: DUG 27/11/2016 WATER LEVEL 27/11/2016

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa												
								0	10	20	30	40	50	60	70	80				
1.80	1.6	ROOTMAT/TOPSOIL																		
		Compact greyish-brown GRAVEL with silt and sand (Alluvium)																		
	-0.5	End of test pit - practical limit of excavation																		
3																				
4																				
5																				
6																				
7																				
8																				
9																				

HARBOURSIDE GEOTECHNICAL CONSULTANTS, TEST PIT RECORD 29/09/17



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TEST PIT RECORD

TP06

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: DUG 28/05/2017 WATER LEVEL 28/05/2017

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa												
								0	10	20	30	40	50	60	70	80				
6.00		ROOTMAT/TOPSOIL																		
5.7		Compact brown GRAVEL with sand - with occasional cobbles and boulders																		
					GB	1	S	○												
3.6		Loose grey well to poorly-graded GRAVEL with sand - wet																		
1.4		End of test pit - practical limit of excavator reach																		
					GB	2	S	○												

HARBOURSIDE GEOTECHNICAL CONSULTANTS, TEST PIT RECORD 28/05/17



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TEST PIT RECORD

TP07

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: DUG 28/05/2017 WATER LEVEL 28/05/2017 *

DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa												
								0	10	20	30	40	50	60	70	80				
14.20	14.0	ROOTMAT/TOPSOIL																		
	13.3	Compact to dense grey to brown GRAVEL with silt and sand - with occasional boulders																		
1		End of test pit - practical refusal on inferred bedrock *no water infiltration observed while test pit was open																		
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				

HARBOURSIDE GEOTECHNICAL CONSULTANTS, TEST PIT RECORD 29/09/17



HARBOURSIDE
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TEST PIT RECORD

TP08

CLIENT HARBOURSIDE ENGINEERING CONSULTANTS PROJECT No. 163545
 LOCATION ROCKY BARACHOIS BRIDGE, GROS MORNE NATIONAL PARK, NL DATUM CGVD28
 DATES: DUG 28/05/2017 WATER LEVEL 28/05/2017 *

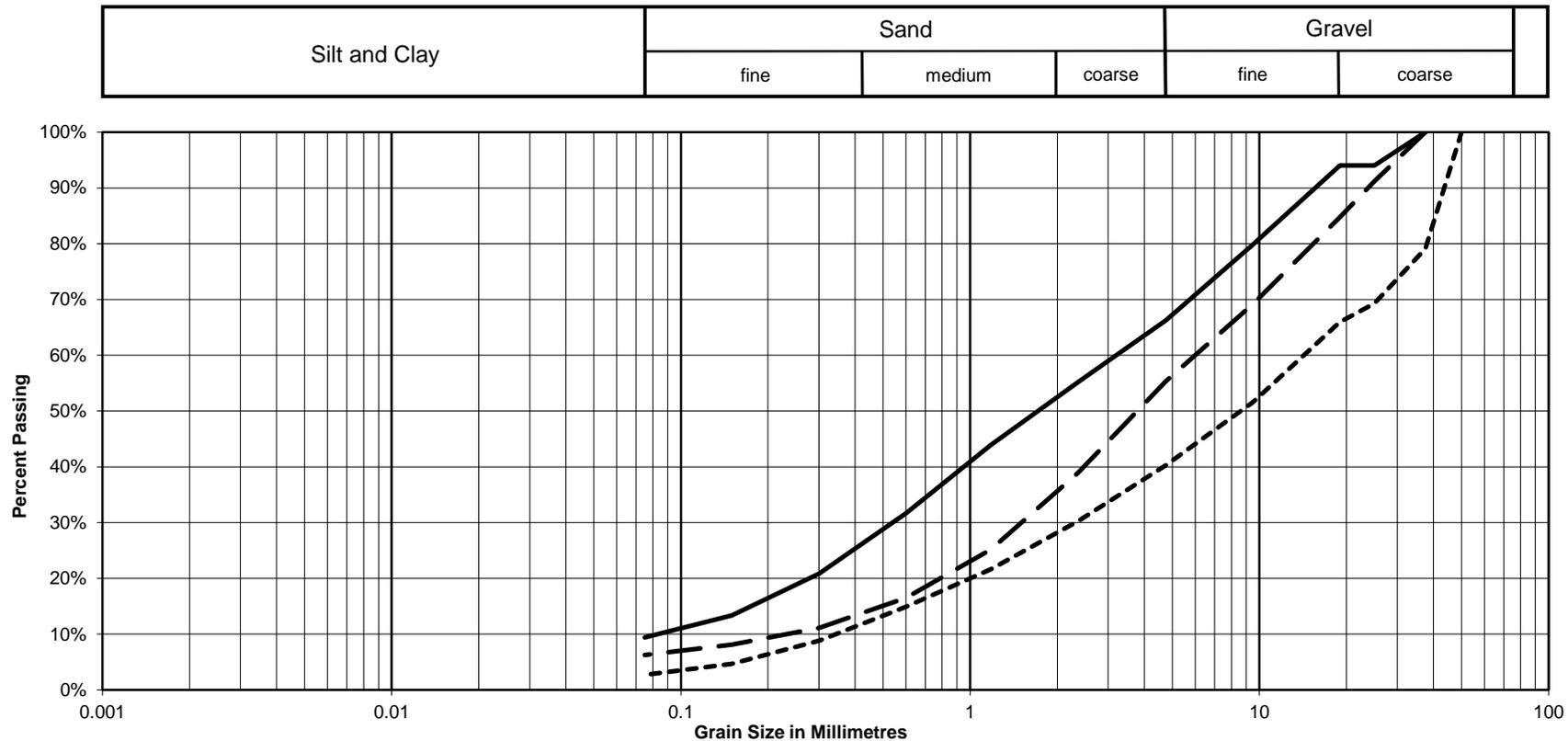
DEPTH (m)	ELEVATION (m)	SOIL/BEDROCK DESCRIPTION	GRAPHIC LOG	WATER LEVEL	TYPE	NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa						
								20	40	60	80			
17.10														
16.9		ROOTMAT/TOPSOIL Stiff brown lean CLAY												
15.9		Compact grey brown silty GRAVEL with sand - with occasional cobbles and boulders			GB	1	S							
15.1		End of test pit - practical refusal on inferred bedrock *no water infiltration observed while test pit was open			GB	2	S							
1														
2														
3														
4														
5														
6														
7														
8														
9														

HARBOURSIDE GEOTECHNICAL CONSULTANTS, TEST PIT RECORD 28/05/17

APPENDIX B

Particle-Size Analyses

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH01	SS2	0.91 - 1.52	34%	57%	9%	Well-Graded Sand with Silt and Gravel
- - -	BH01	SS10	6.10 - 6.71	45%	49%	6%	Well-Graded Sand with Silt and Gravel
. . .	BH01	SS16	9.88 - 10.49	60%	38%	3%	Well-Graded Gravel with Sand

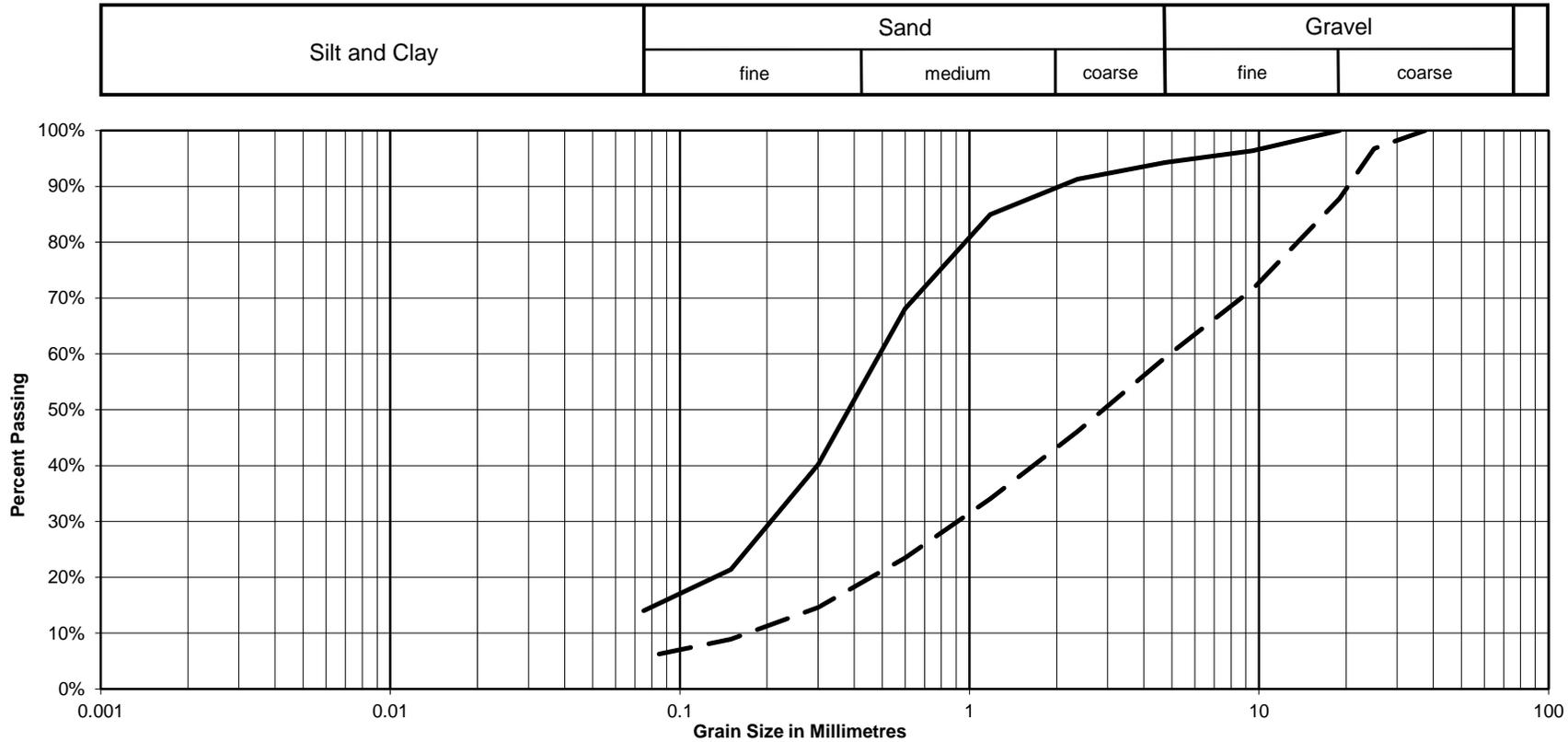
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 219 Waverley Road, Suite 200
 Dartmouth, NS B2X 2C3
<http://harboursideengineering.ca>

CLIENT Harbourside Engineering Consultants
 PROJECT Rocky Barachois Bridge Replacement
 LOCATION Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH01	SS24	15.44 - 16.05	6%	80%	14%	Silty Sand
- - -	BH01	SS28	18.42 - 19.03	41%	54%	6%	Well-Graded Sand with Silt and Gravel

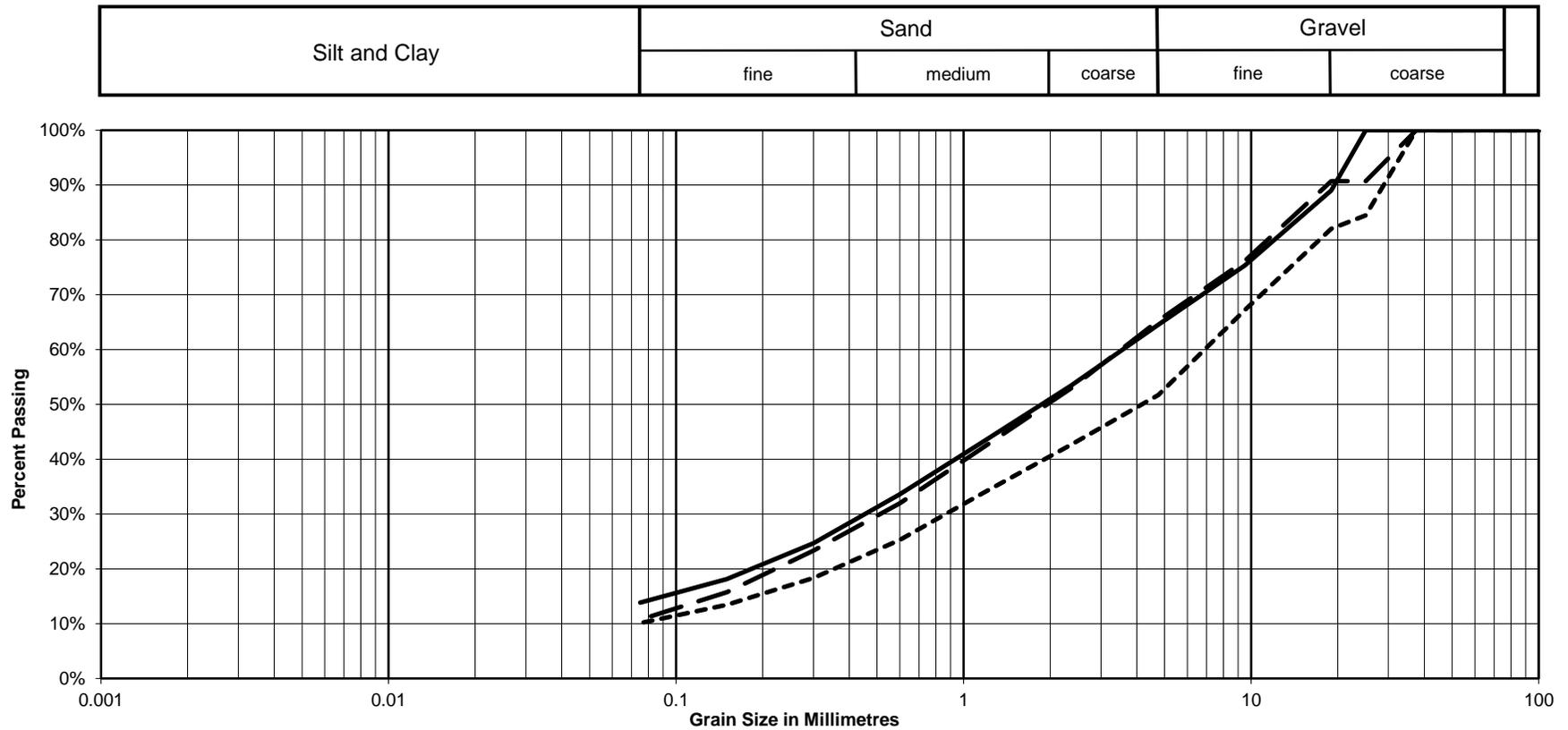
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 219 Waverley Road, Suite 200
 Dartmouth, NS B2X 2C3
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PROJECT	<u>Rocky Barachois Bridge Replacement</u>
LOCATION	<u>Rocky Barachois, Gros Morne National Park, NL</u>

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH02	SS1	0.30 - 0.91	35%	51%	14%	Silty Sand with Gravel
- - -	BH02	SS9	8.18 - 8.79	35%	55%	11%	Well-Graded Sand with Silt and Gravel
. . .	BH02	SS10	9.07 - 9.68	48%	42%	10%	Well-Graded Gravel with Silt and Sand

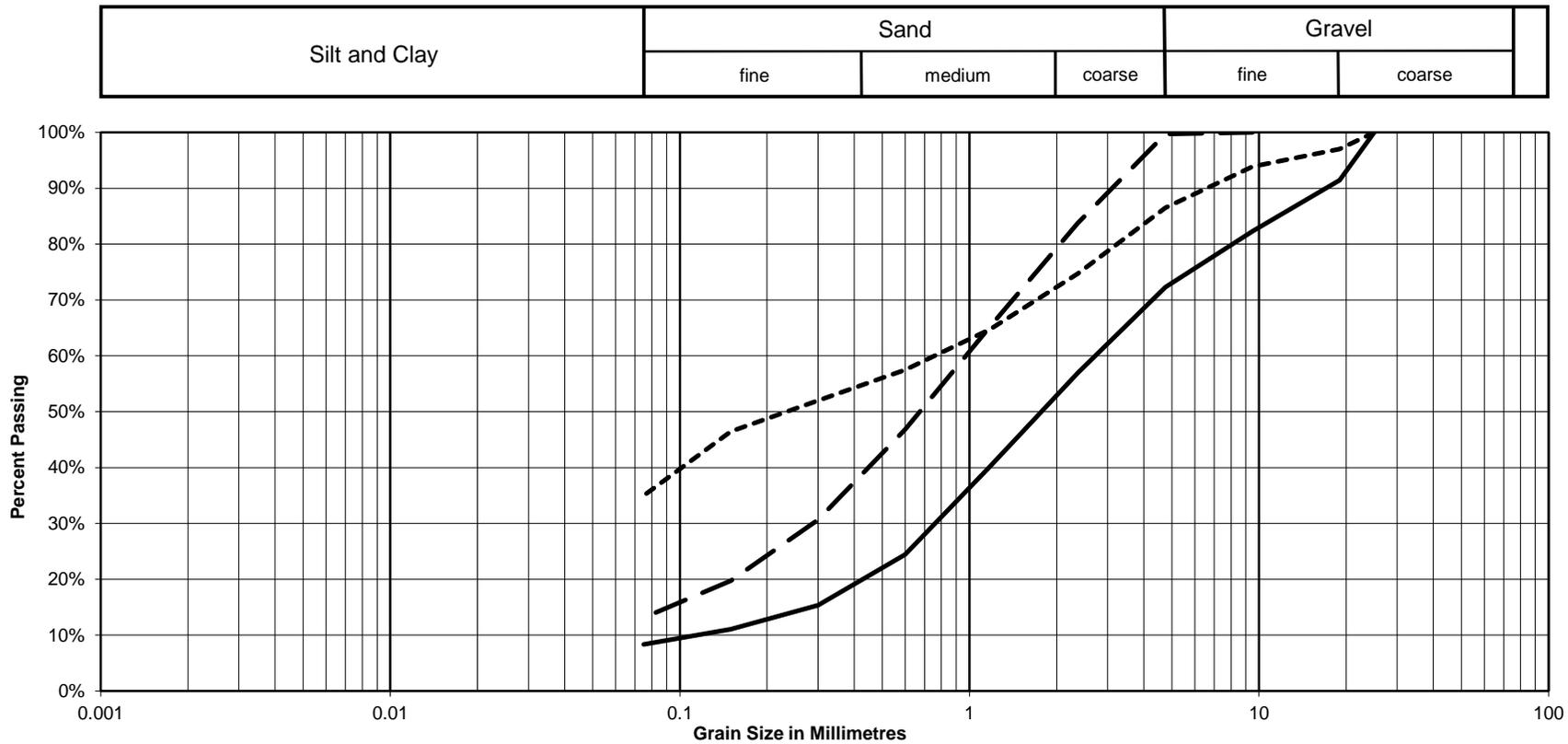
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LOCATION	Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH03	SS5	3.71 - 4.32	28%	64%	8%	Well-Graded Sand with Silt and Gravel
- - -	BH03	SS10	7.16 - 7.86	0%	87%	13%	Silty Sand
. . .	BH03	SS18	16.74 - 17.35	13%	52%	35%	Silty Sand

PROJECT No.: 163545

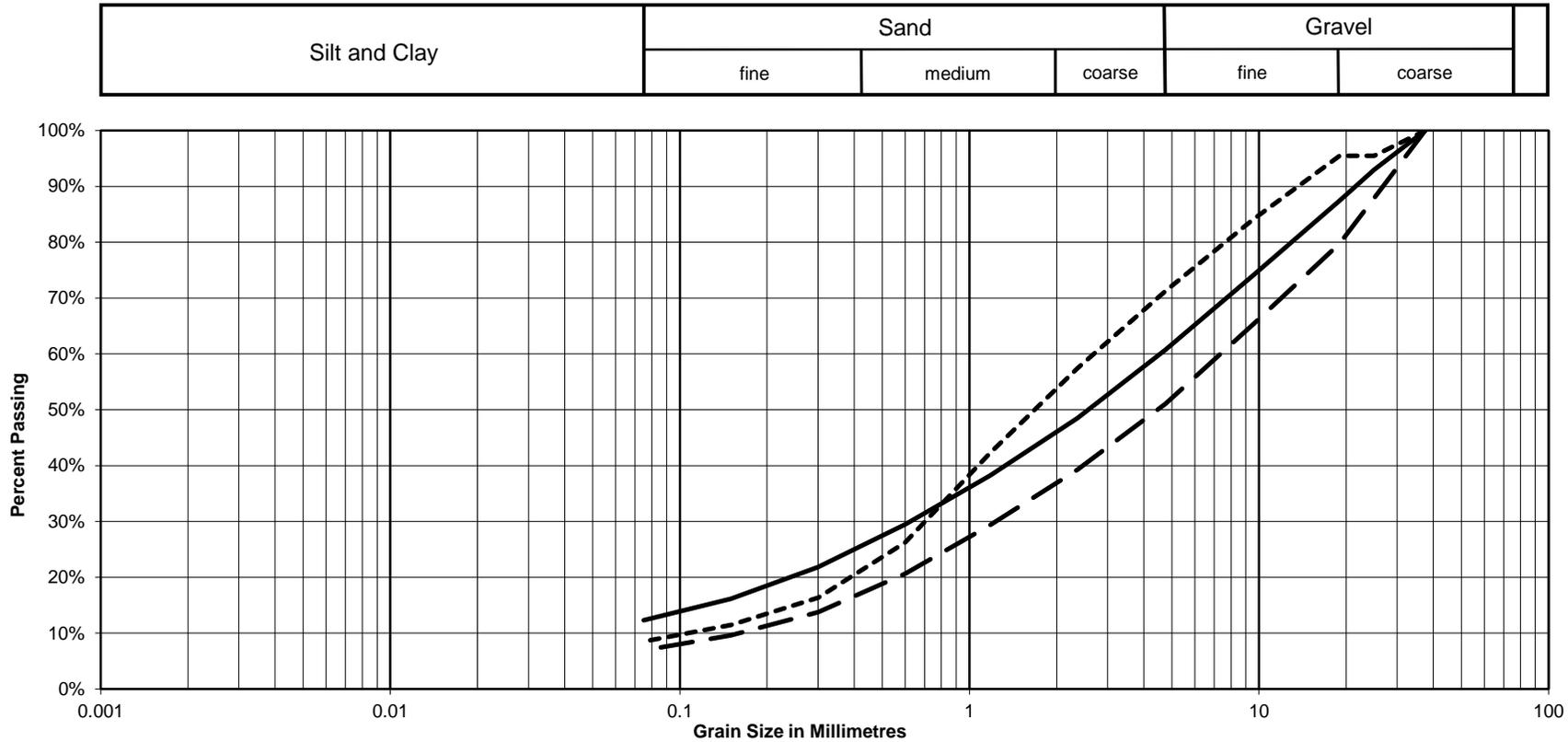


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Rocky Barachois Bridge Replacement
Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH04	SS1	0.25 - 0.86	39%	48%	12%	Well-Graded Sand with Silt and Gravel
- - -	BH04	SS14	9.60 - 10.21	49%	44%	7%	Well-Graded Gravel with Silt and Sand
- . - . -	BH04	SS25	27.73 to 23.34	29%	63%	9%	Well-Graded Sand with Silt and Gravel

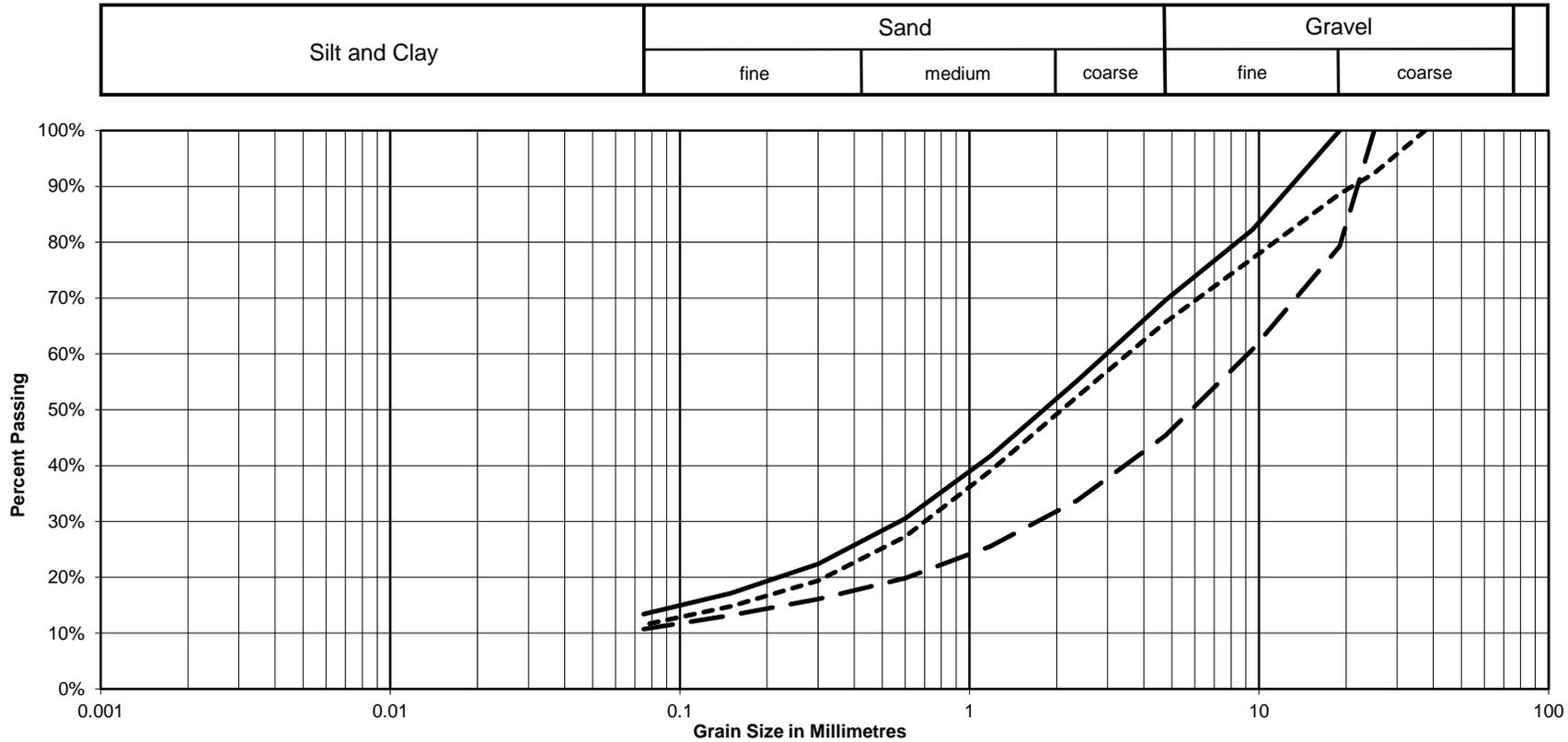
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LOCATION	<u>Rocky Barachois, Gros Morne National Park, NL</u>

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH05	SSB2	1.96 to 2.57	30%	56%	13%	Well-Graded Sand with Silt and Gravel
- - -	BH05	SS6	5.84 to 6.45	55%	35%	11%	Poorly Graded Gravel with Silt and Sand
· · ·	BH05	SS11	9.04 - 9.65	34%	54%	11%	Well-Graded Sand with Silt and Gravel

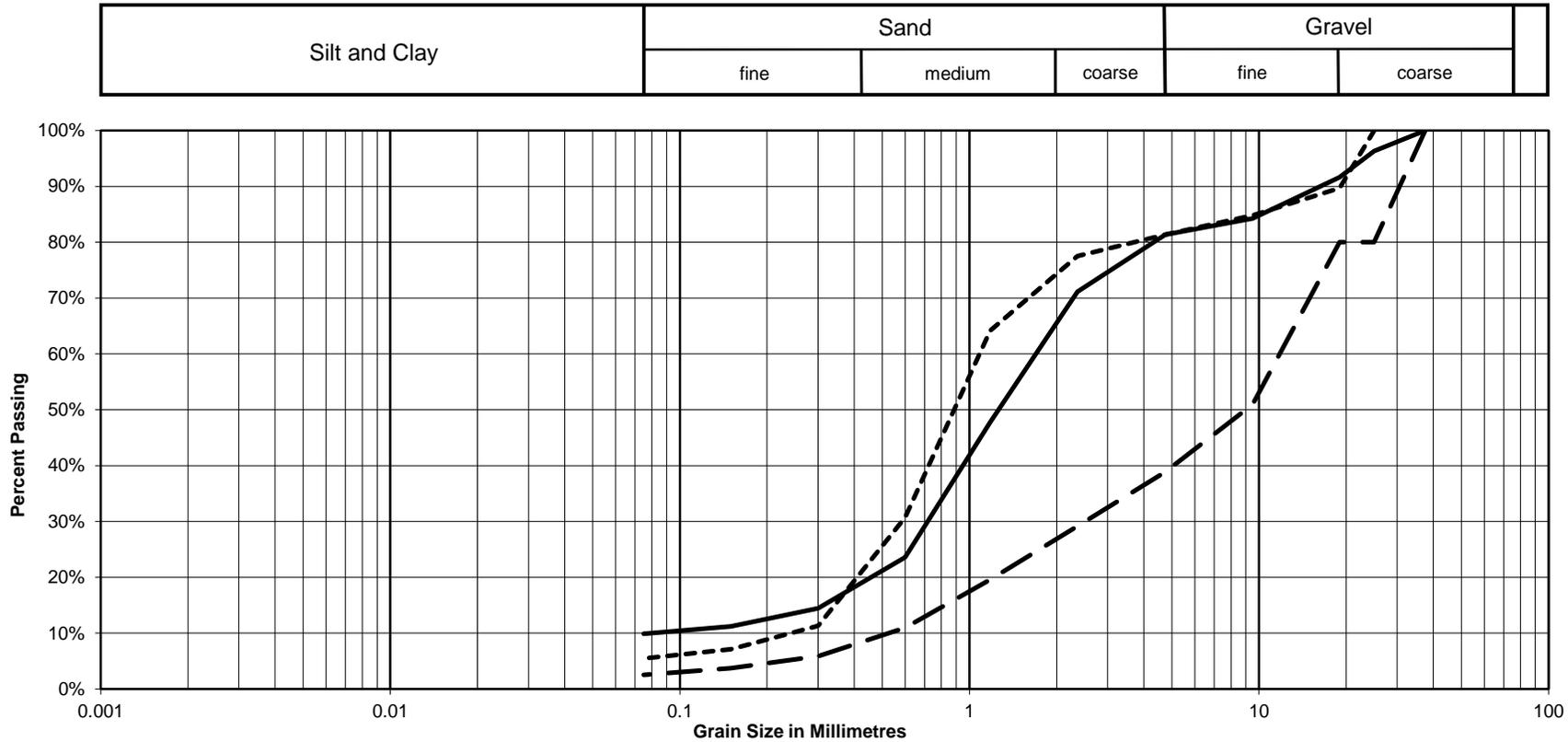
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LOCATION	Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH05	SS16	14.86 - 15.47	19%	71%	10%	Well-Graded Sand with Silt and Gravel
- - -	BH05	SS18	17.98 - 18.59	61%	36%	3%	Well-Graded Gravel with Sand
- · - · -	BH05	SS21	22.45 - 23.06	19%	76%	5%	Poorly Graded Sand with Silt and Gravel

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Rocky Barachois Bridge Replacement
Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION

Silt and Clay	Sand			Gravel	
	fine	medium	coarse	fine	coarse



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH05	SS23	25.32 - 25.93	31%	27%	41%	Silty Gravel with Sand

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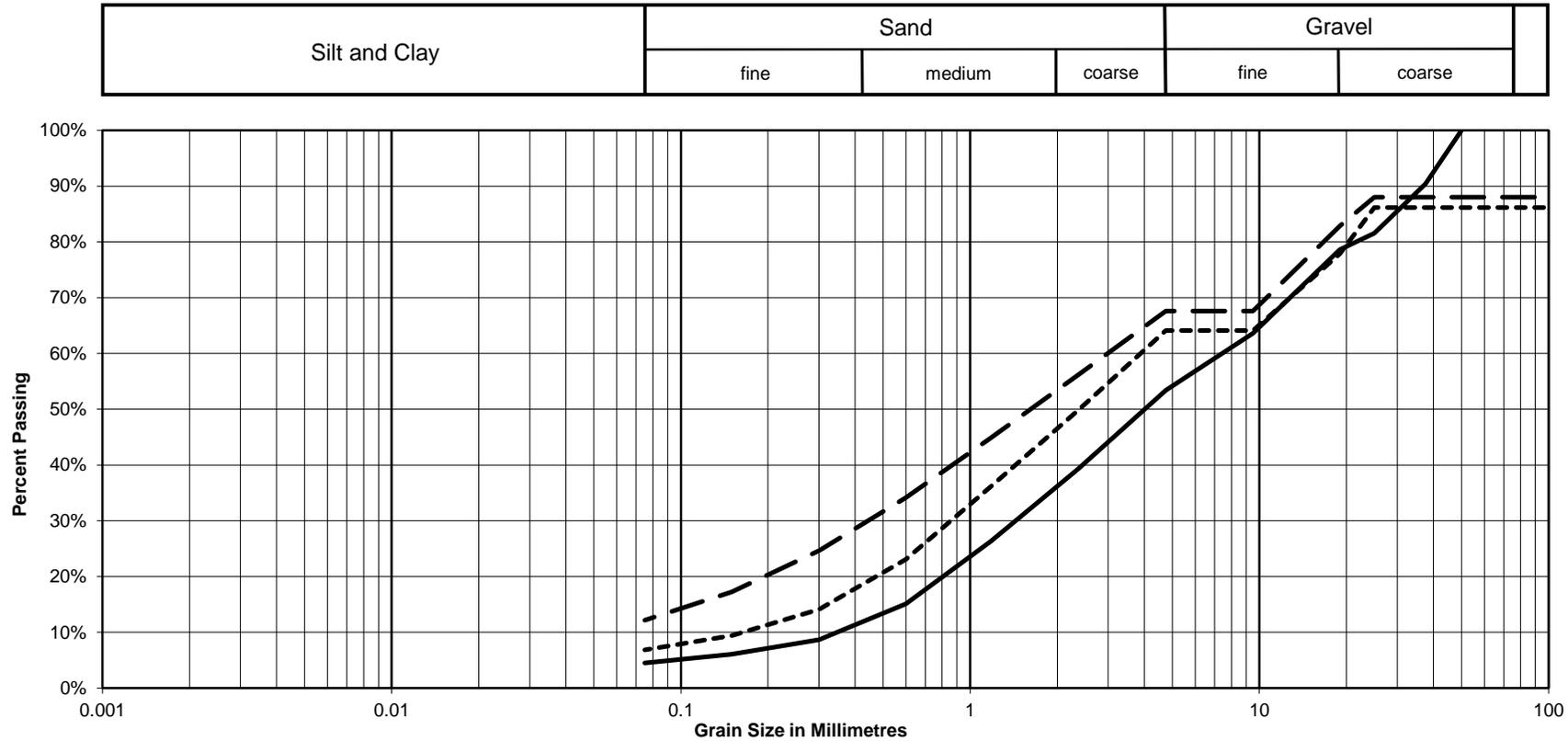


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Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH06	SS1	0.25 - 0.86	32%	55%	12%	Well-Graded Sand with Silt and Gravel
- - -	BH06	SS11	7.44 - 8.05	47%	49%	5%	Poorly Graded Sand with Silt and Gravel
- . - . -	BH06	SS22	15.65 - 16.25	36%	57%	7%	Well-Graded Sand with Silt and Gravel

PROJECT No.: 163545

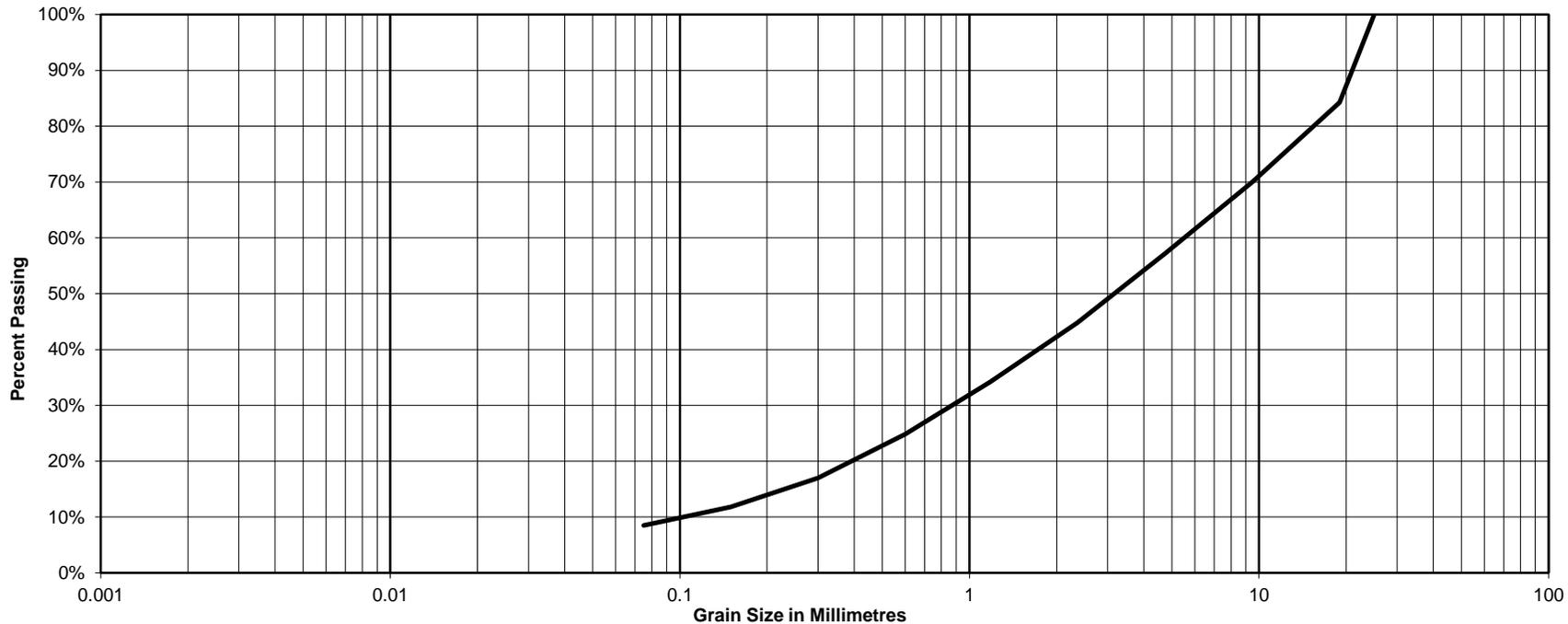


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CLIENT	<u>Harbourside Engineering Consultants</u>
PROJECT	<u>Rocky Barachois Bridge Replacement</u>
LOCATION	<u>Rocky Barachois, Gros Morne National Park, NL</u>

GRAIN SIZE DISTRIBUTION

Silt and Clay	Sand			Gravel	
	fine	medium	coarse	fine	coarse



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH06	SS26	19.48 - 20.09	43%	49%	8%	Well-Graded Sand with Silt and Gravel

PROJECT No.: 163545

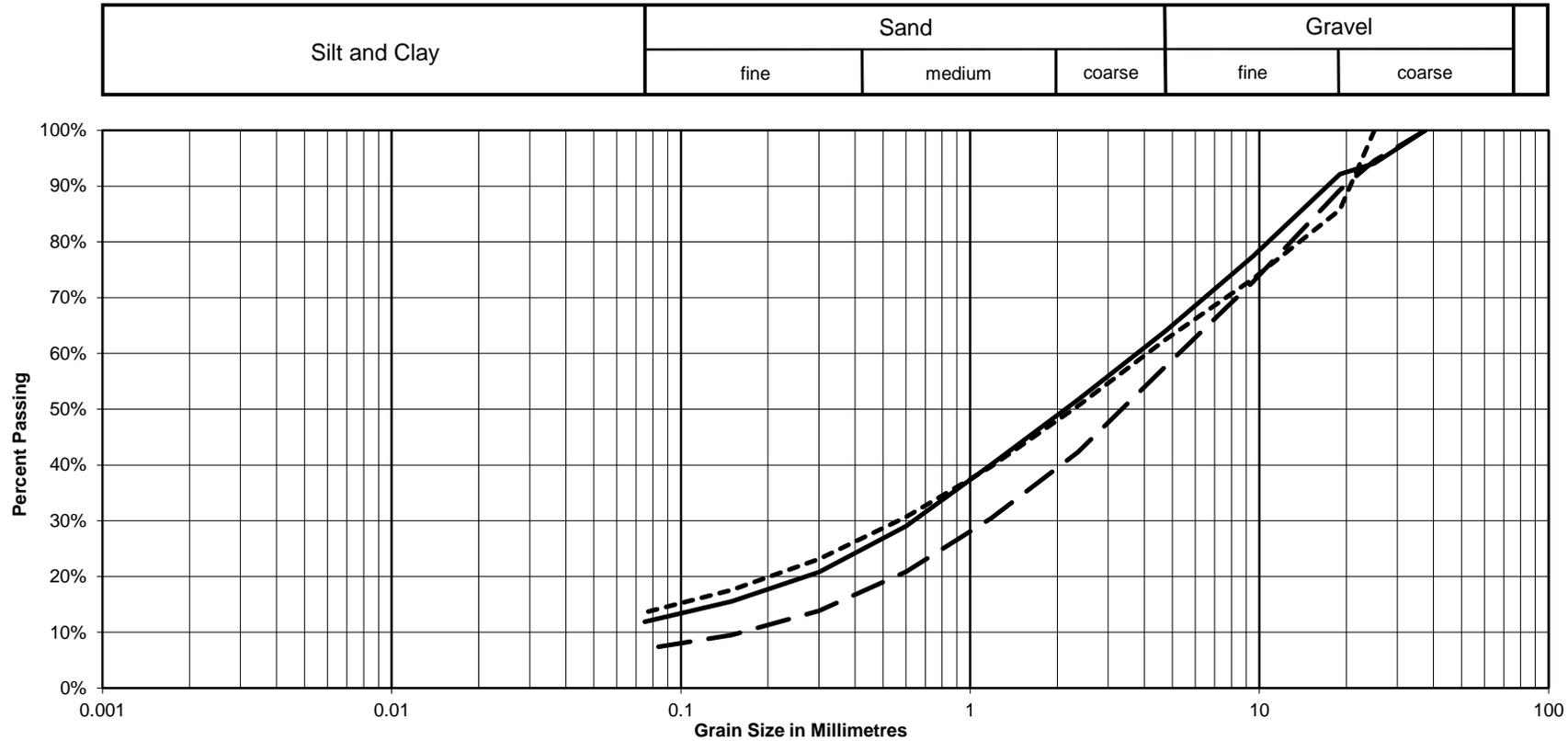


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Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	BH07	SS11	8.08 - 8.69	36%	52%	12%	Well-Graded Sand with Silt and Gravel
- - -	BH07	SS24	20.09 - 20.70	42%	51%	7%	Well-Graded Sand with Silt and Gravel
- . - . -	BH07	SS30	25.45 - 26.06	38%	49%	14%	Silty Sand with Gravel

PROJECT No.: 163545

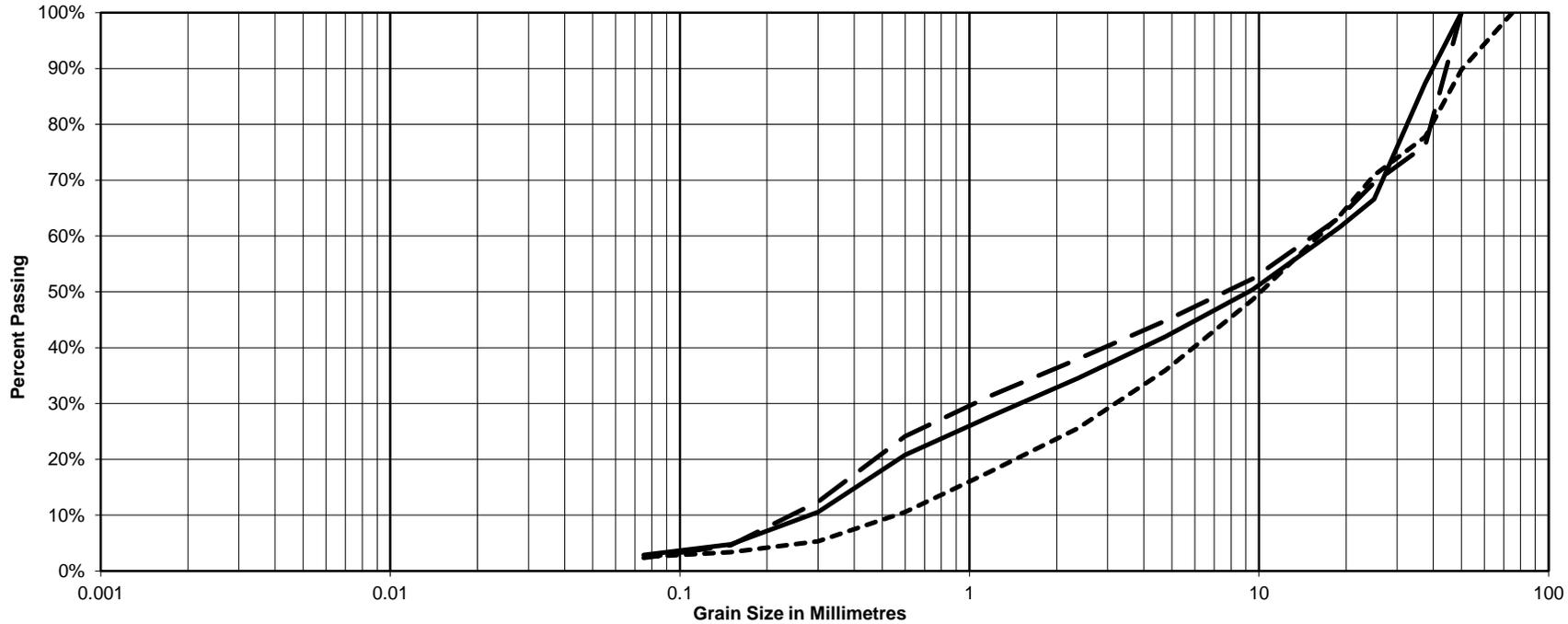


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LOCATION	<u>Rocky Barachois, Gros Morne National Park, NL</u>

GRAIN SIZE DISTRIBUTION

Silt and Clay	Sand			Gravel	
	fine	medium	coarse	fine	coarse



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	TP01	GB1	1.8 - 2.1	58%	39%	3%	Poorly Graded Gravel with Sand
- - -	TP02	GB1	2.4 - 2.7	55%	42%	2%	Poorly Graded Gravel with Sand
- · - · -	TP03	GB1	1.8 - 2.1	64%	33%	3%	Well-Graded Gravel with Sand

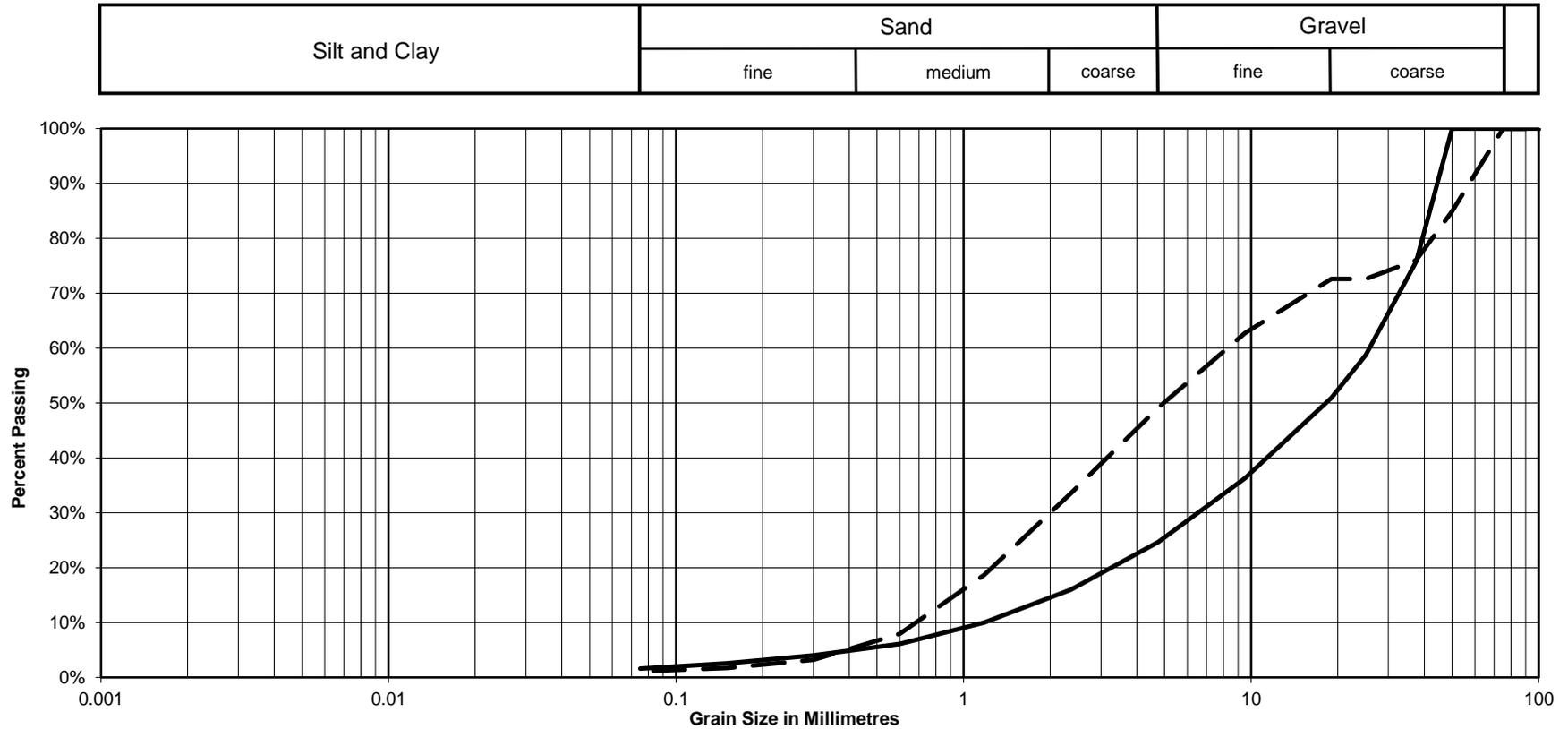
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LOCATION	<u>Rocky Barachois, Gros Morne National Park, NL</u>

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	TP06	GB1	1.22 - 1.52	75%	23%	2%	Well-Graded Gravel with Sand
- - -	TP06	GB2	4.27 - 4.57	51%	48%	1%	Poorly Graded Gravel with Sand

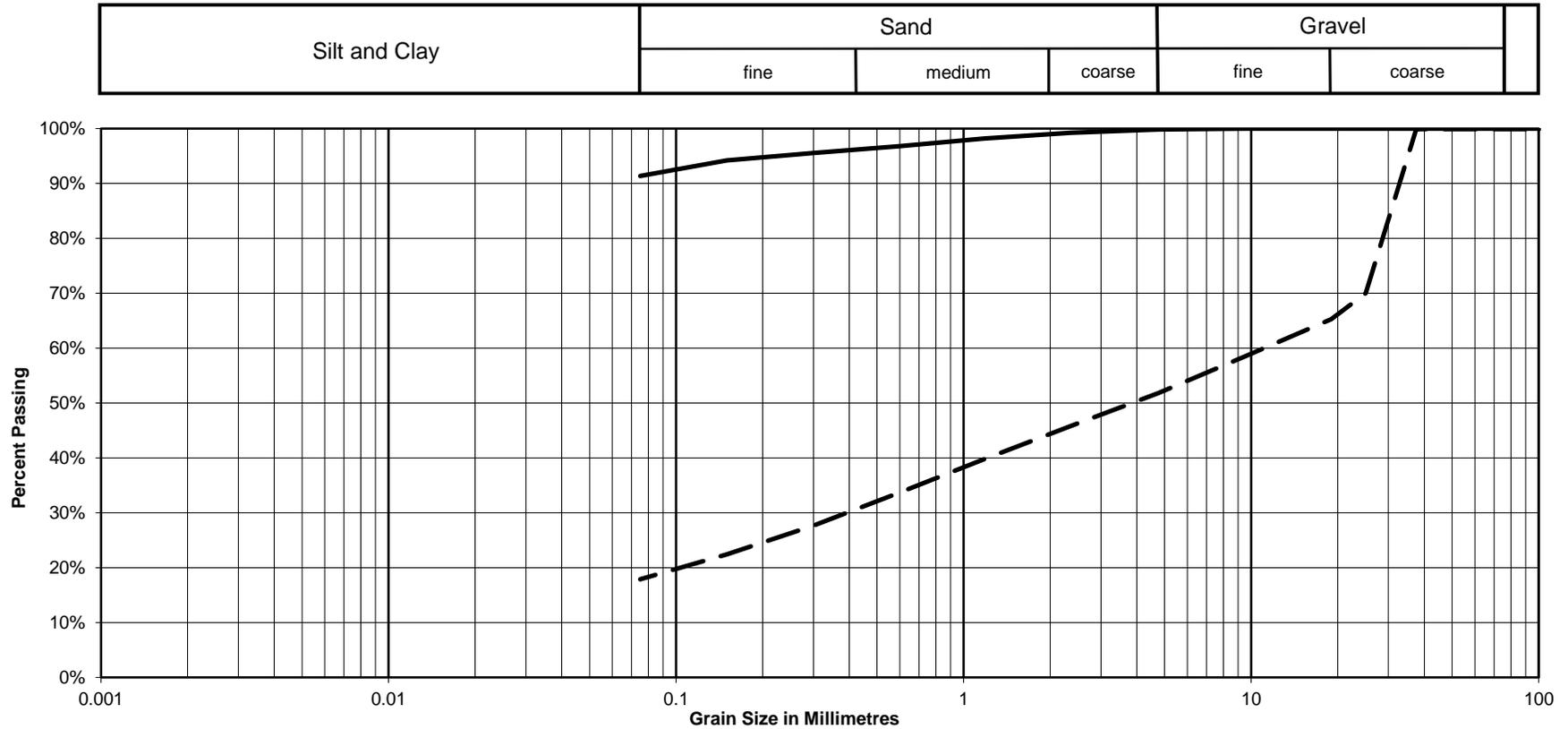
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PROJECT	Rocky Barachois Bridge Replacement
LOCATION	Rocky Barachois, Gros Morne National Park, NL

GRAIN SIZE DISTRIBUTION



CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	TP08	GB1	0.91 - 1.22	0%	8%	91%	Lean Clay
- - -	TP08	GB2	1.52 - 1.83	48%	34%	18%	Silty Gravel with Sand

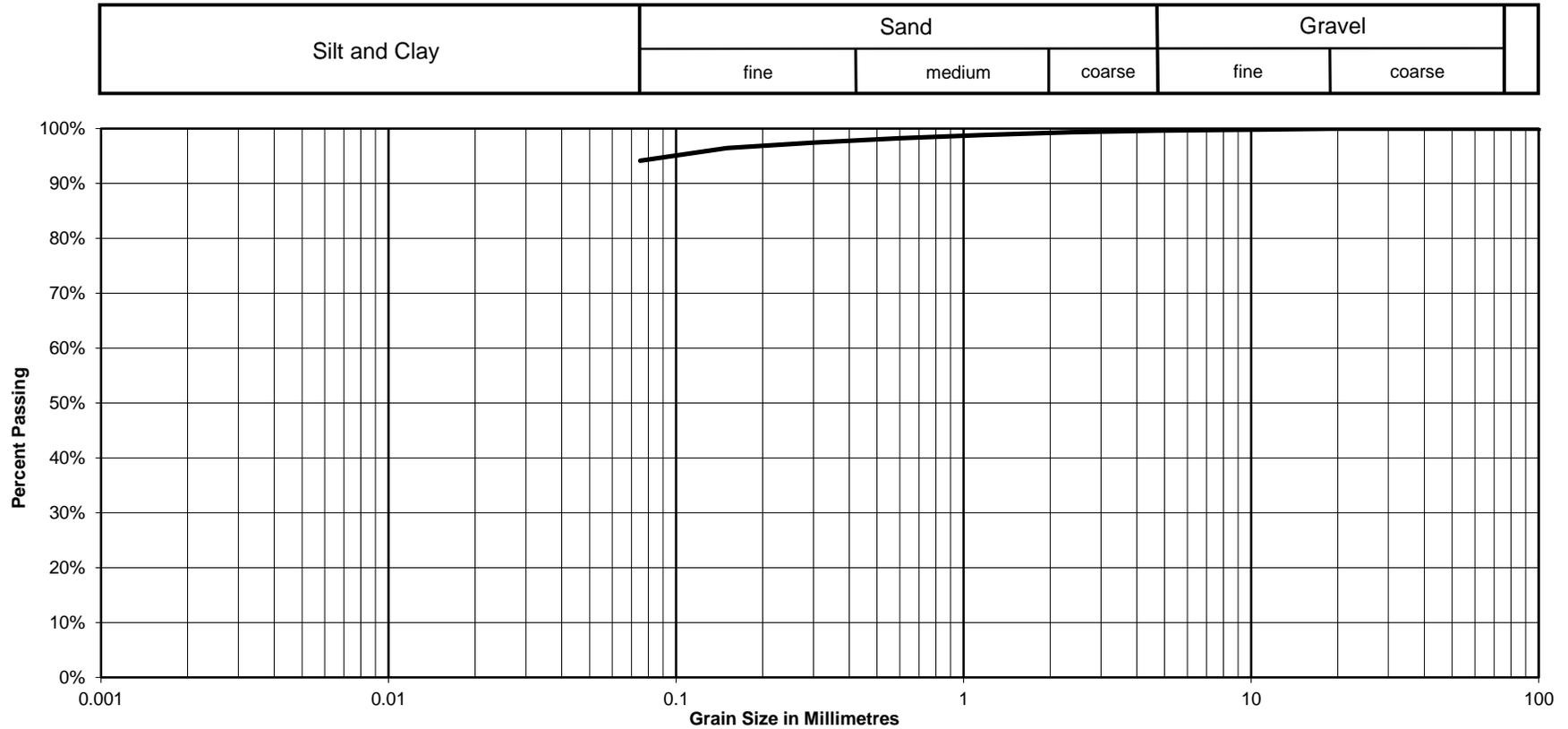
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GRAIN SIZE DISTRIBUTION



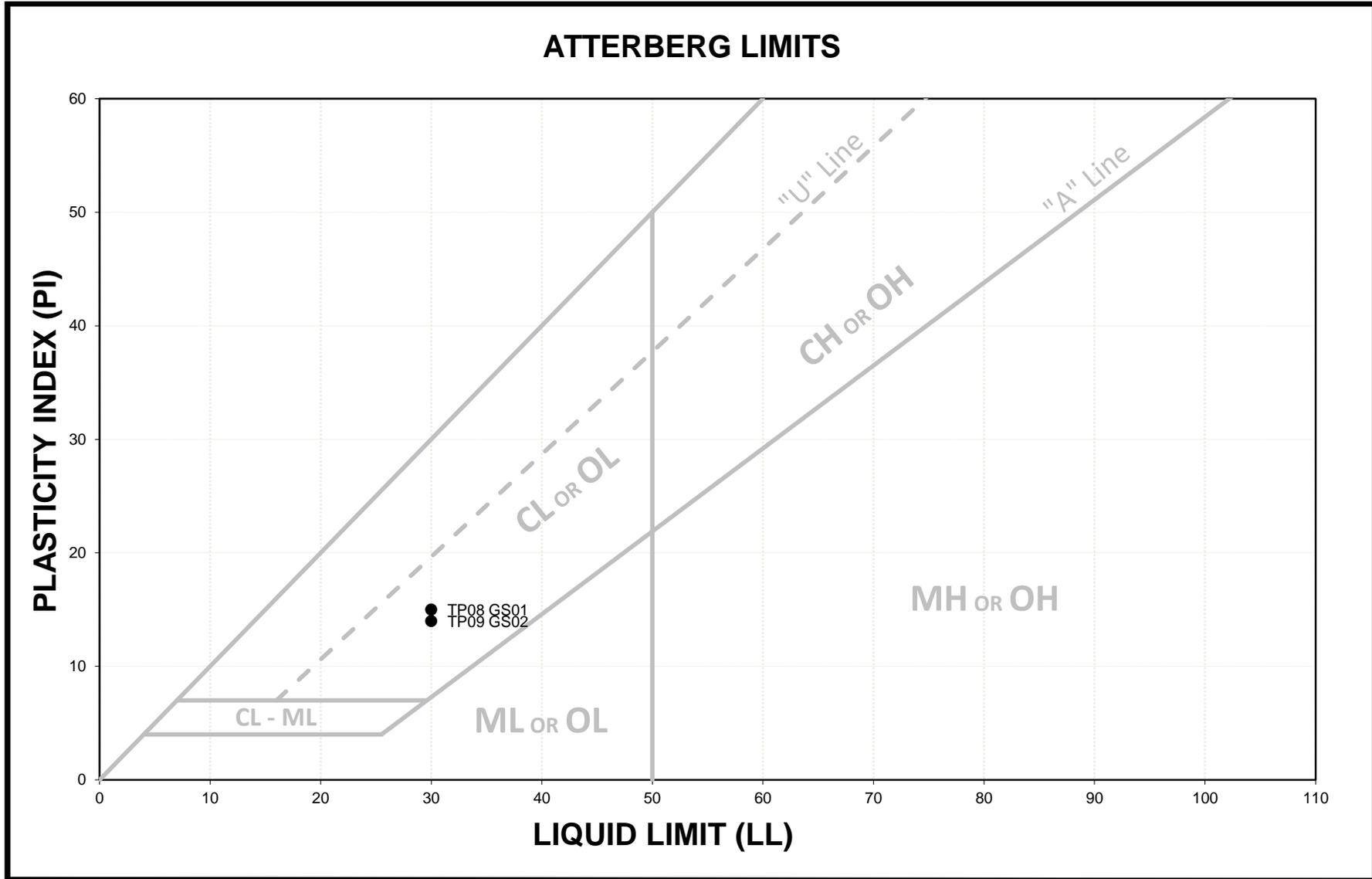
CURVE	BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	SOIL FRACTION			SOIL DESCRIPTION
				GRAVEL	SAND	SILT/CLAY	
—	TP09	GB2	3.96 - 4.27	0%	6%	94%	Lean Clay

PROJECT No.: 163545



t: 1.902.405.4696 | f: 1.902.405.4693
 219 Waverley Road, Suite 200
 Dartmouth, NS B2X 2C3
<http://harboursideengineering.ca>

CLIENT	Harbourside Engineering Consultants
PROJECT	Rocky Barachois Bridge Replacement
LOCATION	Rocky Barachois, Gros Morne National Park, NL



PROJECT No.:



t: 1.902.405.4696 | f: 1.902.405.4693
219 Waverley Road, Suite 200
Dartmouth, NS B2X 2C3
<http://harboursideengineering.ca>

CLIENT
PROJECT
LOCATION

Harbourside Engineering Consultants
Rocky Barachois Bridge Replacement
Rocky Barachois, Gros Morne National Park, NL

APPENDIX C

Sketch No. G1 – Borehole Location Plan

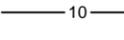
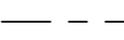
Sketch No. G2 – Test Pit and Push Probe Location Plan

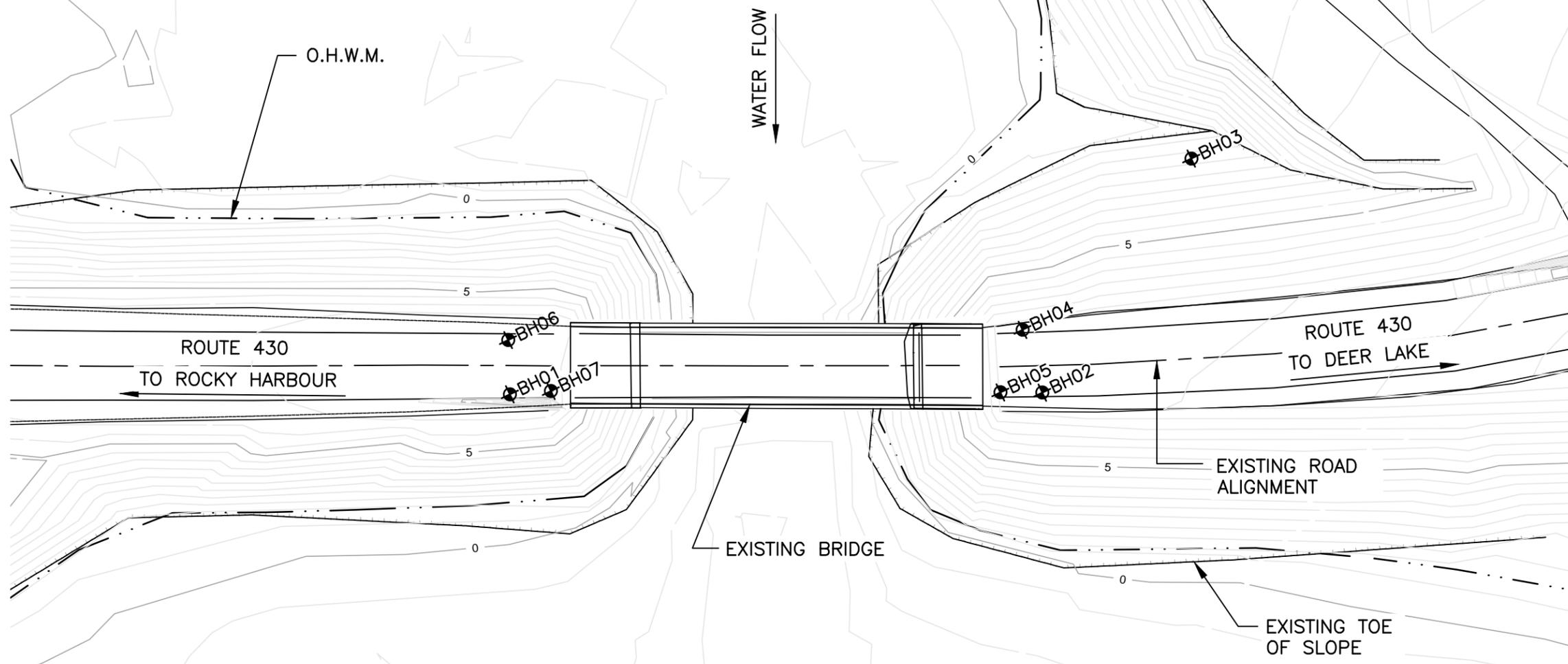


NORTH

ROCKY BARACHOIS
BROOK

LEGEND:

-  BOREHOLE
-  MAJOR CONTOUR
ELEVATION (m)
-  ROADWAY



BOREHOLE LOCATION PLAN

SCALE: 1:500



BOREHOLE COORDINATES			
	NORTHINGS	EASTINGS	ELEVATIONS (m)
BH01	5,480,979.2	446,809.5	6.86
BH02	5,480,928.5	446,827.7	7.70
BH03	5,480,922.2	446,855.0	2.17
BH04	5,480,930.1	446,833.0	7.61
BH05	5,480,932.5	446,826.3	7.53
BH06	5,480,981.2	446,814.6	6.85
BH07	5,480,975.4	446,811.2	6.88

Scale AS NOTED	Date JULY 17, 2017	Drawn D. LARADE	Designed V. GOREHAM	Checked T. MENZIES	Approved T. MENZIES	Contract 163545
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**ROCKY BARACHOIS
BRIDGE REPLACEMENT**

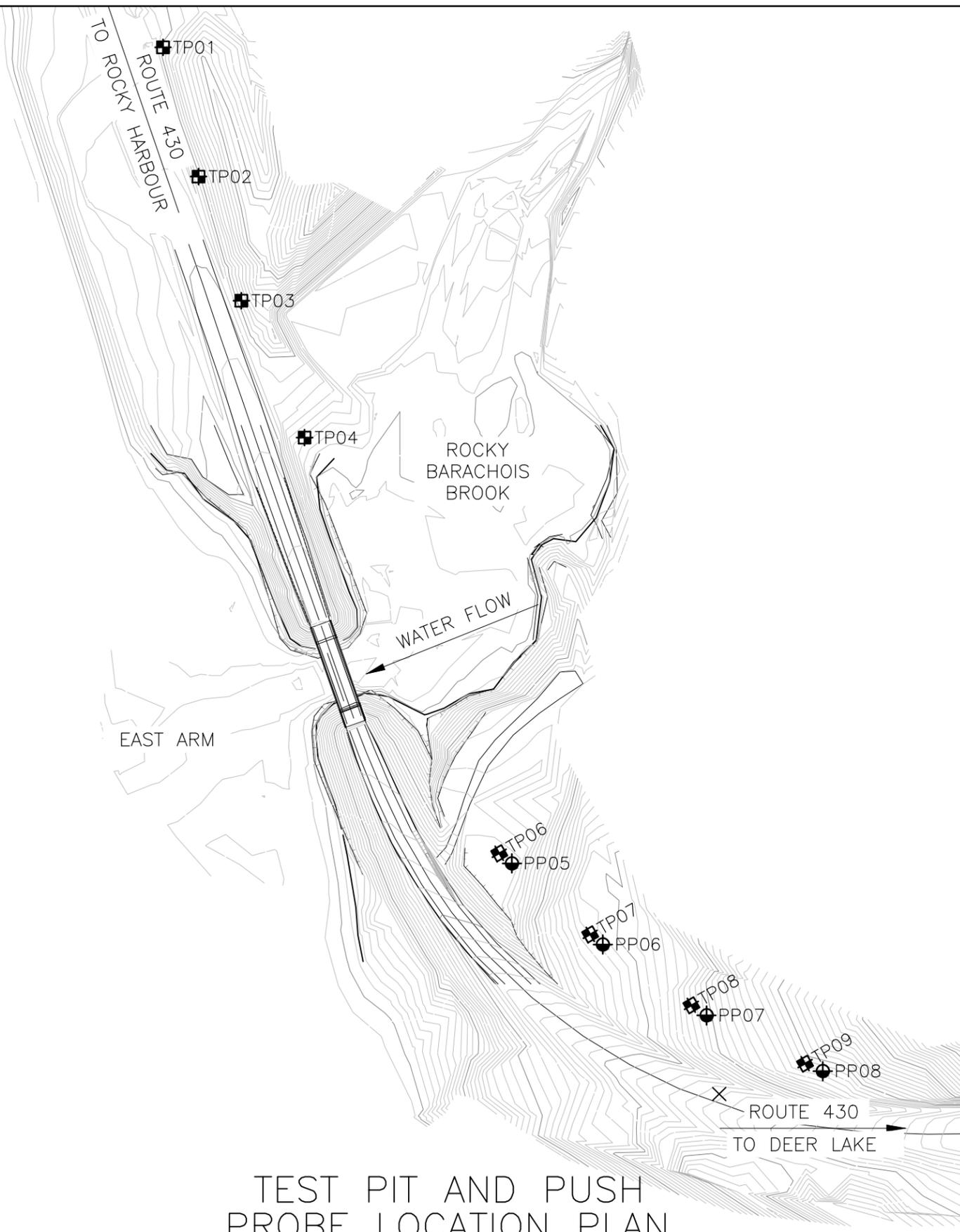
BOREHOLE LOCATION PLAN

SKETCH No.

G1



NORTH



LEGEND:

- TP01 TEST PIT
- PP06 PUSH PROBE
- × BEDROCK OUTCROP

TEST PIT LOCATIONS

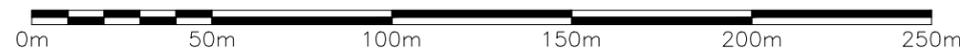
	NORTHINGS	EASTINGS	ELEVATIONS (m)
TP01	5,481,202	446,752	4.8
TP02	5,481,151	446,766	4.2
TP03	5,481,102	446,783	5.5
TP04	5,481,048	446,808	1.8
TP06	5,480,884	446,885	6.0
TP07	5,480,852	446,921	14.2
TP08	5,480,824	446,961	17.1
TP09	5,480,801	447,006	23.3

PUSH PROBE LOCATIONS

	NORTHINGS	EASTINGS	PROBE DEPTHS (m)
PP05	5,480,880	446,890	0.75
PP06	5,480,848	446,926	0.10
PP07	5,480,820	446,967	0.20
PP08	5,480,798	447,013	0.05

TEST PIT AND PUSH PROBE LOCATION PLAN

SCALE: 1:2000



Scale AS NOTED	Date JULY 17, 2017	Drawn D. LARADE	Designed V. GOREHAM	Checked T. MENZIES	Approved T. MENZIES	Contract 163545
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ROCKY BARACHOIS BRIDGE REPLACEMENT

TEST PIT AND PUSH PROBE LOCATION PLAN

SKETCH No.

G2