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END OF SECTION

Specifications
Issued for Tender

Parks Canada Agency

Cobblers Brook and Platters Cove
Culvert Rehabilitation
Terra Nova National Park

Project No. 1099
WSP Canada Inc.



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END OF SECTION

Part 1 General

1.1 PROJECT LOCATION

- .1 The project is located in Terra Nova National Park, Newfoundland and Labrador. The work is located at two separate culvert sites as follows:
 1. Cobblers Brook: double culverts located on Route 1. The South pipe is a multi-plate circular corrugated metal pipe (CMP) with fish weirs and is in alignment with the main channel. The North pipe is a spiral wound circular corrugated metal pipe (CMP) with a concrete paved invert (CPI) which is a high-flow overflow pipe and is used as an animal crossing. The assets are located at coordinates; Latitude: 48.419127, Longitude: -54.134276.
 2. Platters Cove: a single culvert under Route 1, consisting of a spiral wound circular corrugated metal pipe (CMP) culvert with a polymer coating and fish weirs. The asset is located at coordinates; Latitude: 48.429869, Longitude: -54.111759.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Parks Canada is requiring rehabilitation repairs to Cobblers Brook and Platters Cove culverts located under Route 1.
- .2 Work at Cobblers Brook culverts includes:
 - .1 Repairs to deficient separated joints within the North pipe. Repairs include installing a internal expanding bands at each separated joint and injecting voids with Controlled Low Strength Material (CLSM).
 - .2 Installation of temporary water control measures to dewater and isolate the stream flow from the work area. Redirecting the flow to the secondary North culvert as means of providing temporary water control at this site, however alternate methods may be considered with the approval of the Departmental Representative.
 - .3 Construction of erosion control structures at both ends of the South culvert by installing new cast-in-place reinforced concrete collars and cut off walls, as per the issued construction drawings.
 - .4 Filling of voids behind the walls of the culverts with controlled low strength material (CLSM) in the South pipe. Locations to be filled are indicated on the Soil Sight Report attached herein.
 - .5 Cleaning out debris buildup in the South pipe only.
- .3 Work at Platters Cove culvert includes:
 - .1 Installation of temporary water control measures to dewater and isolate the stream flow from the work area. A temporary water control pipe will be required to be inserted through the entire length of the existing culvert to provide the temporary water control at this site.
 - .2 Repairs to the culvert inlet and outlet cut off wall by grouting joint as shown on the drawings.

- .3 Filling of voids behind the walls of the culvert with controlled low strength material (CLSM). Location as per Soil Sight Report attached herein.
- .4 Repairs to deficient separated joints.
- .5 Cleaning out debris buildup in the culvert.
- .4 Demolition work at Cobblers Brook and Platters Cove includes:
 - .1 Removal of guiderail for site access, as required.
 - .2 Demolition design shall include all the access, safe removals, and mitigation measures required to complete the work in an environmentally friendly manner.
- .5 Route 1 work at Cobblers Brook and Platters Cove generally includes:
 - .1 Reinstatement of any Vehicle W-Beam Guide Rail required to be removed for construction access.
 - .2 Final landscape finishing of all slopes disturbed by access during construction.
 - .3 Temporary traffic control during all phases of construction including delivery to site of materials and equipment.
- .6 The above listed work is subject to the following constraints during construction:
 - .1 In-water work shall be in accordance with the approved Temporary Water Control plan and accompanying documents completed for this project.
 - .2 In-water work is limited to setting up temporary water control barriers to dewater and isolate the flow from the work areas.
 - .3 Construction activities shall not detrimentally impact the surrounding environment or the waterway and shall respect allowable windows for in-water work.
- .7 The Contractor is responsible for the delineation of the construction zones and the existing highway.
- .8 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 Park Act and Regulations, Canadian Environmental Protection Act, and the Code of Practice of the Department of Labour.

1.3 CONTRACT METHOD

- .1 Construction work under combined unit price and lump sum items contract.

1.4 CODES

- .1 Perform Work in accordance with National Parks Act, Code of Practice of the Department of Labour, as it pertains to the Traffic Control Manual (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 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.
- .4 Vehicle weights and dimensions shall conform to Highway Traffic Act (Newfoundland and Labrador).

1.5 WORK WITHIN PARK BOUNDARIES

- .1 The project is within a National Park, and it is essential that all 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, bear the expense to immediately restore such damaged areas to the satisfaction of the Departmental Representative.
 - .2 If Contractor fails to repair damage to the satisfaction of the Departmental Representative, the Departmental Representative may complete repairs at the Contractor's expense.
 - .3 Confirm that contracted Work meets the standards outlined in the contract specification and drawings.
 - .4 All sources of aggregate and concrete, controlled low strength material (CLSM), and grout mix-designs must be submitted to the Departmental Representative for approval prior to the pre-construction meeting.
 - .5 The Contractor is responsible to follow the Provincial requirements regarding the following:
 - .1 Pit and Quarry Guidelines;
 - .2 Environmental Construction Practice specifications
 - .6 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.

1.6 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each of following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field Test Reports.
 - .8 Copy of Approved Work Schedule.
 - .9 Health and Safety Plan and Other Safety Related Documents.

- .10 Plan Locating Underground Utilities.
- .11 Other Documents as Specified.
- .12 Environmental Control Plan.
- .13 Record drawings (kept up to date on a daily basis).

1.7 SITE CONDITIONS

- .1 The Contractor will be responsible to visit the culvert sites and review existing site conditions.
- .2 For further information, photos and descriptions of the culvert defects, refer to the three (3) reports prepared by Inversa Solutions dated November 5, 2021, attached in Appendix A. Any interpretations of the reports' findings will be made at the Contractor's own risk and the Department Representative and/or Consultant will not be held responsible for the interpretation of this document.
- .3 Promptly notify Departmental Representative if subsurface conditions differ materially from those indicated in Contract Documents or a reasonable assumption of probable conditions based on thereon.

1.8 WASTE DISPOSAL

- .1 All waste generated from this project will be disposed of outside of Park boundaries.

1.9 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.
- .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, or via conference call/ virtually. This meeting will review implications of the contract, design, schedule of work, methods of construction, environment protection methods and traffic control.
- .3 The project completion date is July 31st, 2022.
- .4 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.
- .5 No work will begin until the pre-construction meeting is held.
- .6 Following the pre-construction meeting and approval of the schedule and traffic control plan, the work will be so scheduled to meet the time restraints and have the project completed on time.

1.10 PARTIAL OCCUPANCY OR USE

- .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.

1.11 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. Project Limits/Construction Limits are as follows:
 - .1 Lateral: Clearing limits.
- .2 The Contractor shall maintain the site in a tidy condition free from the accumulation of waste products and debris. Upon substantial performance of the work, remove surplus products, tools, machinery and equipment from the site. Completion of clean-up is required for total performance of the work.
- .3 Contractor shall provide any and all traffic control services required for the project.
- .4 Contractor to obtain all necessary permits to perform work and to comply with all permit requirements and conditions.

1.12 PROJECT MEETINGS

- .1 The Contractor will arrange project meetings at the call of the Departmental Representative and assume responsibility for setting times and recording and distributing minutes in accordance with Section 01 31 19 – Project Meetings.

1.13 SETTING OUT OF WORK

- .1 Contractor shall carry out all layouts for the Work.
- .2 Contractor shall assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .3 Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.
- .4 Provide coordinates, elevations and dimensions in the field, as required by the Departmental Representative

1.14 EXISTING SERVICES

- .1 The Contractor shall confirm all inverts and critical elevations in the field (as required) prior to construction.
- .2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.
- .3 Carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.
- .4 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shutdown or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .6 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

- .7 Record locations of maintained, re-routed and abandoned service lines.
- .8 Ensure pedestrian and other traffic is not unduly impeded, interrupted or endangered by execution or existence of work.
- .9 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.

1.15 EXISTING ROADWAY SIGNS

- .1 The Contractor shall note that existing warning, regulatory and information signs may exist along the roadway within the project limits.
- .2 These signs shall be protected from damage.
 - .1 If any damage occurs during construction, the Contractor shall bear the expense to immediately replace such damaged signs and/or posts to the satisfaction of the Departmental Representative.
- .3 If the Contractor needs to temporarily remove the existing signs in order to complete their work, the removal and reinstatement shall be considered incidental.

1.16 ADDITIONAL DRAWINGS

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

1.17 STANDARD HOURS

- .1 The Contractor must maintain existing site hours for the work unless otherwise authorized by Departmental Representative.
- .2 Work that involves temporary disruption of services will be scheduled through the Departmental Representative. Give Departmental Representative minimum 72 hours' notice of any disruption of services.

1.18 RELICS, ANTIQUES & 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.

1.19 MEASUREMENT OF QUANTITIES

- .1 Linear: Items which are measured by metre or kilometre, such as pipe culverts will be measured along centreline of installation unless otherwise shown on plans.

- .2 Area:
 - .1 Longitudinal and transverse measurements for areas to be measured horizontally.
 - .2 Longitudinal and transverse measurements for such items as clearing to be made on actual flat or sloped surface.
- .3 Volume:
 - .1 In computing volumes of excavation, average end area method will be used unless otherwise directed by Departmental Representative in writing.
 - .2 Term: Litre shall mean 1000 mL or L.
- .4 All volume measurements refer to in place measure unless specified elsewhere in specification.
- .5 Mass:
 - .1 Term "tonne" shall mean 1000 kg.
 - .2 Materials which are specified for measurement by mass shall be weighed on scales at a location determined by the Contractor. 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.
- .6 Time:
 - .1 Unless otherwise provided for elsewhere or by written authority of 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 hours of operation. Devices which only measure hours of running of motor will not be accepted.

1.20 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.

1.21 WORK SEQUENCE

- .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.

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 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and 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 Maintain existing services and provide for vehicle access at all times with the exception of the dates as stated in Section 01 11 00.
- .3 All site activities related to construction are to be confined within the defined project boundaries.
- .4 No work camps will be located within the boundaries of the Terra Nova National Park.
- .5 Water: in accordance with Departmental Representative's approval.
- .6 Temporary storage parking areas and turn around facilities for Contractor related equipment and vehicles will be limited to those areas agreed to and designated by the Departmental Representative.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to travelling 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.

1.5 SPECIAL REQUIREMENTS

- .1 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .2 Keep within limits of work and avenues of ingress and egress.
- .3 Work shall be conducted in accordance with Parks Canada BIA (if provided) and BMP's.
- .4 Special Move Permits (over-weight and over-dimension) from the Province shall be submitted to Departmental Representative for review and approval prior to activity.
- .5 Maintenance work on Contractor/Sub-Contractor equipment is prohibited within the National Park.

- .6 If native topsoil is encountered during excavation, the Contractor shall salvage and stockpile such that embankments and designated areas can be dressed with the salvaged topsoil at the end of project prior to hydroseeding and dry mulch.
- .7 Maintain roadways, detours and site signage at all times during the Contract (i.e. dust control and free from potholes, bumps, etc.)
- .8 Guide rail shall be installed at the same locations from which existing guide rail was removed, unless noted otherwise on the Drawings or by the Departmental Representative.
 - .1 Where existing guide rail is to be removed and new guide rail is to be installed at the same location, the Contractor shall complete the installation within the same working day or provide full physical protection of the region with traffic barrier protection meeting the approval of the Departmental Representative.
- .9 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.

1.6 SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

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 DESCRIPTION

- .1 Mobilization and Demobilization consists of the preparatory work and operations including, but not limited to, those necessary for the loading, transportation, unloading, and complete set-up of all equipment, labour, materials and incidentals necessary to complete the work associated with the Contract, as well as, the decommissioning, loading, transportation, unloading and storage of all equipment, excess materials, facilities and incidentals after the work associated with the Contract is complete.

1.2 RELATED REQUIREMENTS

- .1 Section 01 11 00 – Summary of Work.

1.3 MEASUREMENT FOR PAYMENT

- .1 See Section 01 29 00 – Payment Procedures.

1.4 DESCRIPTION

- .1 There shall be no change in the Lump Sum Price of this Item due to a change in Contract scope or an extension to the Contract Completion Date.
- .2 The payments from the Lump Sum Price shall be full compensation for the Work under this Item regardless of the number of times the Contractor mobilizes.
- .3 At no time shall the total of the amounts paid to the Contractor under this Item be greater than the Contractor's Lump Sum Price.
- .4 For those purposes of mobilization and demobilization, "project site" means the location.

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 GENERAL REQUIREMENTS OF THE BID AND ACCEPTANCE FORM

- .1 Unit prices and Lump Sum prices bid are full compensation for the work necessary to complete each item in the Contract and in combination for all work necessary to complete the Work as a whole.
- .2 All measurements shall be along a horizontal plane unless otherwise indicated.
- .3 The quantities listed in the Bid and Acceptance Form are approximate only and are for the purpose of tendering. Payment to the Contractor will be based on actual quantities of work completed in accordance with the Drawings and Specifications.
- .4 The numbers of the items described below correspond to the numbers of the items in the Bid and Acceptance Form.
- .5 Should the Contractor need to remove any existing regulatory/warning/information signs or posts in order to complete their Work, the removal and reinstatement of the signs and posts shall be considered incidental.
- .6 Should the Contractor need to remove any existing Vehicle W-Beam Guide Rail in order to complete their Work, the removal and reinstatement and/or replacement of all guide rail components shall be considered incidental to the Work.
- .7 There will be no measurement or payment for Work carried out beyond the limits defined on the Drawings.

1.2 MEASUREMENT AND PAYMENT

- .1 All items in this Contract will be paid for as indicated in the bid items below:
- .2 Lump Sum Item 1 – Section 01 25 20 – Mobilization / Demobilization
 - .1 Terms of Payment: Lump Sum (LS).
 - .2 This item includes: For 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.
- .3 Lump Sum Item 2 – Section 01 35 00.06 - Special Procedures for Traffic Control
 - .1 Terms of Payment: Lump Sum (LS).
 - .2 This item includes:
 - .1 Traffic control persons and traffic accommodation person(s).
 - .2 Provision, installation and maintenance of temporary traffic control devices, including detour signs, construction signage, portable variable message signs, temporary traffic control signals and pad sites for

- temporary traffic control signals, portable variable message signs and mobile speed radar units.
- .3 Traffic control devices and measures required to comply with Department of Transportation & Works Newfoundland and Labrador's Traffic Control Manual including but not limited to all labour, materials and equipment related to traffic control, Accredited Sign Supervisor, traffic control signage, flashing light units, jersey barriers, traffic barrels and all incidentals.
- .4 Lump Sum Item 3 – Section 31 23 33.01 – Excavating, Trenching and Backfilling (Temporary Water Control Works)
- .1 Terms of Payment: Lump Sum (LS).
- .2 This item includes:
- .1 Dewatering of sites and all temporary water control works.
- .2 All environmental protection items including sedimentation and erosion control measures required to complete the project, such as (but not limited to) diversion ditching, silt fences, temporary ground covers in accordance with Parks Canada National Best Management Practices – Roadway, Highway, Parkway and Related Infrastructure. Also included is the periodic and general maintenance of all erosion control measures or as directed by the Departmental Representative.
- .5 Other Items Not Included in the Unit Price Table
- .1 Unit of Measurement is Lump Sum (LS).
- .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:
- Cleaning of debris buildup within the required culvert(s) as noted in the Specifications.
 - Restoration of all areas disturbed during the progress of the work (to conform to or exceed all applicable standards) including existing riprap on slopes, roadway subgrade, gravel sub-base, gravel base, landscaping, hydraulic seeding and dry mulching. All related work will not be measured and shall be considered as incidental to the Work.
 - Project layout, permits and approvals required to complete the job shall be considered incidental to the Work.
 - Reinstatement and/or replacement of any Vehicle W-Beam Guide Rail the Contractor has removed, including guiderail, posts, reflectors, installation, backfilling, compaction, disposal of excess material and reinstatement of disturbed surfaces. Reinstatement and/or replacement of all Vehicle W-Beam Guide Rail shall follow the specifications outlined in Section 34 71 13.25 Vehicle W-Beam Guiderail. All related work will not be measured and shall be considered as incidental to the Work

- .6 Unit Price Item 1 – Section 03 30 00 - Cast-in-Place Concrete
- .1 Unit of Measurement is Cubic Meter (m³)
 - .2 This item includes supply, formwork, placing, compacting and finishing of all concrete for the Reinforced Concrete Collars including all excavation and/or clearing required to complete the work. Measurement shall be based on Contract Drawings with no deduction for displacement by reinforcement.
- .7 Unit Price Item 2 – Section 03 60 10.02 - Controlled Low Strength Material (CLSM)
- .1 Unit of Measurement is Cubic Meter (m³)
 - .2 This item includes supply, placing, injection, finishing (as required) of all CLSM for filling voids behind the culvert walls and under cutoff walls. All preparation work for the CLSM including drilling and sealing the CLSM insertion points will be incidental to this item.
- .8 Unit Price Item 3 – Section 33 42 13.01 – Sealing of Culvert Joints
- .1 Unit of Measurement is per culvert joint to be sealed (each).
 - .2 This item includes supply and installation of the Mechanically Fastened Band, mortar, rivets and all other items required for the sealing of the culvert joints. Unless specified otherwise, all necessary work for the completion of the sealing of culvert joints will be incidental to this item.

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 REQUIREMENTS

- .1 Section 03 30 00 Cast in Place Concrete
- .2 Section 03 65 00 Controlled Low Strength Material (CLSM)
- .3 Particular requirements for inspection and testing to be carried out by testing laboratory designated by the Departmental Representative are specified under various sections.

1.2 APPOINTMENT AND PAYMENT

- .1 The 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 conveying systems, mechanical and electrical equipment and systems.
 - .4 Tests specified to be carried out by Contractor under the supervision of the Departmental Representative.
- .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 the 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 the Departmental Representative sufficiently 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 the Departmental Representative.

1.4 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting two days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and Departmental Representative.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 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 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
 - .1 Schedule of Work: in bar (GANNT) Chart format.
 - .2 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .3 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .4 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .5 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .6 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .7 Appointment of inspection and testing agencies or firms.
 - .8 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and one week prior to project completion, schedule progress meetings bi-weekly.
- .2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.
- .3 Notify parties minimum two days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 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 Corrective measures and procedures to regain projected schedule.
 - .6 Revision to construction schedule.
 - .7 Progress schedule, during succeeding work period.
 - .8 Review submittal schedules: expedite as required.
 - .9 Maintenance of quality standards.
 - .10 Review proposed changes for effect on construction schedule and on completion date.
 - .11 Other business.

1.4 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and 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.
- .11 Make any changes in submissions which Departmental Representative may require to be consistent with Contract Documents and resubmit as directed by Departmental Representative.
- .12 Notify Departmental Representative, in writing, when resubmitting of any revisions other than those requested by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Newfoundland and Labrador of Canada.
- .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 10 days 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, 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 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copies 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 accord with specified requirements.
 - .2 Testing must have been within one year of date of contract award for project.
- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested 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 copies of manufacturers' instructions for requirements requested in specification Sections and as requested 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 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies 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.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.

- .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.

1.4 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution, monthly with progress statement as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints:
 - .1 Viewpoints and their location as determined by Departmental Representative.

1.5 WORK SCHEDULE

- .1 Provide within 5 working days after contract award, schedule showing anticipated progress stages and final completion of work within time period required by Contract Documents.
- .2 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

1.6 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 REQUIREMENTS

- .1 Section 03 30 00 Cast in Place Concrete
- .2 Section 03 60 10.02 Controlled Low Strength Material
- .3 Section 31 23 33.01 Excavating, Trenching and Backfilling
- .4 Section 33 42 13.01 Sealing of Culvert Joints

1.2 REFERENCES

- .1 Newfoundland and Labrador Transportation and Works (NLTW):
 - .1 Newfoundland & Labrador Transportation and Works Traffic Control Manual, latest edition.
 - .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 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 minimize interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Close lanes of road only after receipt of written approval from Departmental Representative.
 - .1 Before re-routing traffic erect suitable signs and devices to NLTW Traffic Control Manual.
- .4 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
 - .1 Provide 7 m wide minimum temporary roadway for traffic in two-way sections through Work and on detours.
 - .2 Provide 4.5 m wide minimum temporary roadway for traffic in one-way sections through Work and on detours.
- .5 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, except where other means of road access exist that meet approval of Departmental Representative.

1.4 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights, variable message signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
 - .1 Construction of temporary pads, if required for the placement of temporary traffic control devices or portable variable message signs shall be supplied by the Contractor. Temporary pad sites shall be approved by the Departmental Representative.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to NLTW Traffic Control Manual.
- .3 Place signs, delineators, barricades and miscellaneous warning devices in locations recommended in NLTW Traffic Control Manual.
 - .1 If situation on site changes, revise to approval of Departmental Representative.
- .4 The Contractor shall provide a Temporary Workplace Signer (TWS), who has successfully completed the Temporary Workplace Traffic Control Training Course, to be on site at all times when active construction is taking place. The Temporary Workplace Signer will be responsible to assess condition, prepare, implement and review traffic control plans for construction. The Temporary Workplace Signer will be responsible for ongoing compliance with the NLTW Traffic Control Manual and for ensuring the safe regulation of traffic and safe passage of pedestrians at temporary workplaces. The Temporary Workplace Signer is considered part of the Contractor's supervision and administration staff and compensation for the provision of this individual is considered incidental to the work.
- .5 A traffic control plan and emergency response plan must be submitted for review by the Departmental Representative prior to the pre-construction meeting.
- .6 Continually maintain traffic control devices in use:
 - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Remove or cover signs which do not apply to conditions existing from day to day.

1.5 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag personnel who have a valid provincial license, trained in accordance with, and properly equipped to NLTW Traffic Control Manual for situations as follows:
 - .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 a traffic control signal system is not in use.

- .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
- .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
- .5 For emergency protection when other traffic control devices are not readily available.
- .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
- .7 At each end of restricted sections where pilot cars are required.
- .2 All Traffic Control Personnel shall be equipped with portable radios of sufficient range to ensure continuous communication within the traffic control zone.
- .3 All construction vehicles shall operate in accordance with and are subject to traffic control restrictions and operations in place on the project.

1.6 OPERATIONAL REQUIREMENTS

- .1 Existing conditions for traffic within right-of-way containing work in this Contract are indicated by following descriptions:
 - .1 Section within Park Boundaries within contract limits are asphalt concrete surfaced two lane undivided trunk roadway with posted speeds up to 60 km/h.
 - .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 and approved by Departmental Representative to protect and control public traffic, existing conditions for traffic may be restricted as follows:
 - .1 In accordance with NLTW Traffic Control Manual.
 - .2 The maximum cumulative traffic delay associated with work carried out under this Contract shall not exceed 10 minutes (between 0900hrs and 1600hrs) through the Contract limits during peak season (1 July to 30 August). Outside the peak season a 20 minute maximum cumulative delay within the Contract limits will be permitted.
 - .3 Maintain existing conditions for traffic crossing right-of-way containing work except that, when required for construction under this Contract and when measures have been taken as specified herein and approved by Departmental Representative to protect and control public traffic.
- .3 At the end of each day of work, traffic must be returned to two-lane two-way traffic. Restrictions of one lane traffic overnight or outside of work hours will not be permitted, unless approved otherwise by Departmental Representative.
- .4 Temporary structures shall be constructed as indicated on approved shop drawing submitted to Departmental Representative. All existing dimensions to be verified prior to construction with any discrepancies reported to the Departmental Representative.
- .5 The Contractor shall provide for services 24 hrs per day, 7 days per week.
- .6 Major responsibilities of the traffic accommodation person:

- .1 Maintain traffic control devices and signs during regular shutdown on weekends and at night throughout the week.
- .2 Clean signs, flares, barricades, etc. used to control and accommodate traffic.
- .7 Contact proper authorities in the event of an emergency, i.e., Contractor's Supervisor, Park Warden, and Departmental Representative.

1.7 MEASUREMENT FOR PAYMENT

- .1 See Section 01 29 00 – Payment Procedures.

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 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Newfoundland and Labrador:
 - .1 Occupational Health and Safety Act, - Updated 2013.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit electronic copies of Contractor's authorized representative's work site health and safety inspection reports to authority having jurisdiction and Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within seven days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within five days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.
- .11 Submit other data, information and documentation upon request as stipulated elsewhere in this Section.

1.3 FILING OF NOTICE

- .1 File Notice of Project and any other required Notices with the Provincial Authorities prior to commencement of the work. Provide the Departmental Representative with a copy of the filed Notice(s) prior to commencement of the work.

1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. Have Contractor's site safety supervisor in attendance. Departmental Representative will advise of time, date and location of the meeting and will be responsible for recording and distributing the minutes.
- .2 Conduct site specific occupational health and safety meetings as required by the NL Occupational Health and Safety Act, and the Regulations made pursuant to the Act for the duration of the work.
- .3 Record and post minutes of all meetings in plain view on the work site. Make copies available to Departmental Representative upon request.
- .4 Conduct an orientation meeting with all workers prior to start-up of the Work to ensure everyone is aware of the Health and Safety issues for this specific project. Each new worker to receive the same orientation briefing prior to performing any work on this project.

1.6 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Continuous movement of public traffic through the construction site at all hours of the day and night with the exception of dates listed in Section 01 11 00.
- .2 The above list shall not be construed as being complete and inclusive of all safety and health hazards encountered as a result of Contractor's operations during the course of work. Include above items into the hazard assessment program specified herein.

1.7 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Health and Safety Plan shall contain the following three (3) parts:
 - .1 Part 1: List of individual health risks and safety hazards identified by hazard assessments.
 - .2 Part 2: List of specific measures to control or mitigate each hazard and risk identified in part one of Plan. Describe the engineering controls, personnel protective equipment and safe work practices to be implemented and followed when performing work related to each identified hazard or risk.

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- .3 Part 3: Emergency Measures and Communications Procedures as follows:
 - .1 Emergency Measures: on-site operating procedures, evacuation measures and emergency response to be implemented in the occurrence of an incident. Procedures to be specific and relevant to identified hazards. Measures to complement and be integrated with the facility and tenants Emergency Response Plans in place at site. Obtain information on existing emergency and evacuation plans from Departmental Representative and incorporate appropriate data.
 - .2 Communication Procedures:
 - .1 List of names and telephone numbers of designated officials, to be contacted should an incident or emergency situation occur, including the following.
 - .1 General Contractor and all Subcontractors.
 - .2 Federal and Provincial Departments and local emergency resources organizations, as resources organizations, as applicable laws and regulations.
 - .3 Officials from Parks Canada. Departmental Representative will provide list of names to be included.
 - .2 Procedures implemented at site to communicate and share information between workers, subcontractors, and General Contractor on work activities and in particular those which might endanger workers and Facility employees.
 - .3 Develop Health and Safety Plan in Collaboration with all subcontractors. Address all work and activities of subcontractors as they arrive on site. Immediately update Plan and submit to Departmental Representative.
 - .4 Implement, maintain and enforce compliance with requirements of the Health and Safety Plan until final completion of work and demobilization from site.
 - .5 As work progresses, review and update Plan addressing additional health risks and safety hazards identified by on-going hazard assessments.
 - .6 Submit revised versions of Plan to Departmental Representative.
 - .7 Post a typed written copy, including all updates of the Health and Safety Plan in a common visible location at work site.
 - .8 Submission of the Health and Safety Plan, and updates to the Departmental Representative is for review and information purposes only. Its submission shall not be construed to imply approval by Departmental Representative, be interpreted as a warranty of being complete, accurate and legislate compliant and shall not relieve the Contractor of his legal obligations for the provision Health and Safety of the Construction Project.
 - .9 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with Occupational Health and Safety Act, Occupational Safety General Regulations.
- .3 Carry out work placing emphasis on health and safety of the public, Parks Canada employees, site personnel and protection of the environment.
- .4 The Contractor is responsible to manage safety of the work site to ensure that any persons, including but not limited to, the general public circulating adjacent to the work operations are protected against harm due to the extent that they may be affected by conduct of the work.
- .5 Prior to commencement of work, provide site safety orientation sessions for all workers and other authorized persons.
- .6 The Contractor is responsible to ensure Contractor employees and sub-contractors accessing the work site are in possession of and wear appropriate personnel protective equipment (PPE).

1.9 UNFORESEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.10 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with pavement rehabilitation projects completed with live traffic.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.
- .2 The Health and Safety Co-ordinator shall be required to conduct regularly scheduled safety inspections of the work site as follows:
 - .1 Informal inspections on a minimum daily basis noting deficiencies and remedial actions taken in a log book or diary. Make the log book and/or diary available

for the Departmental Representative's viewing as requested. The log book shall be submitted on a bi-weekly basis to the Departmental Representative.

- .2 Formal inspections on a minimum weekly basis, and shall provide a written report to the Departmental Representative for each formal inspection, document deficiencies, remedial action needed and assign responsibility for rectification to the appropriate party.

1.11 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

1.12 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by 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 may stop Work if non-compliance of health and safety regulations is not corrected.

1.13 BLASTING

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

1.14 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

1.15 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 unauthorized persons from circulating within construction areas and remove from site.
- .2 Implement procedures for granting permission to enter into 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, hoarding and temporary lighting as required.
- .4 Erect signage at entry points and at other strategic locations around site, clearly identifying construction area(s) as being "off limits" to unauthorized persons. Signage must be professionally made in both official languages or by use of well-understood graphic symbols.
- .5 Secure site at night time or provide security guard(s) as deemed necessary to protect site against entry.

- .6 Ensure persons granted access are 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.

1.16 PROTECTION

- .1 Provide temporary facilities for protection and safe passage of public pedestrians and vehicular traffic around adjacent work site during all times except during full road closure periods as specified in Section 01 11 00.
- .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.
- .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.

1.17 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 the Work.

1.18 MINIMUM SITE SAFETY RULES

- .1 Notwithstanding the requirement to abide by 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 personal protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety vest and safety footwear. Wear eye protection where appropriate.
 - .2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.
 - .3 Maintain site in tidy condition.
 - .4 Obey warning signs and safety tags.
- .1 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.

1.19 TOOLS AND EQUIPMENT SAFETY

- .1 Implement and follow a scheduled tool and equipment inspection/maintenance program at work site. Regularly check tools, equipment and machinery for safe operation and perform maintenance at pre-established time and frequency intervals as recommended by manufacturer. Include sub-contractor's equipment as part of the inspection process.
- .2 Use standardized checklists to ensure established safety checks are stringently followed.

- .3 Immediately tag and remove items found faulty or defective off site.
- .4 Maintain written documentation on each inspection. Make available to Departmental Representative upon request.

1.20 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 Put all MSDS data sheets on site, in a common area, visible to workers.

1.21 PROJECT / SITE CONDITIONS

- .1 The following are known or potential project related safety hazards at site:
 - .1 Highway Traffic.
 - .2 Wildlife
- .2 Obtain from Departmental Representative, copy of MSDS Data sheets of existing hazardous materials stored on site or being used by Facility and Tenant personnel in the course of their operations.
- .3 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. Include above items into the hazard assessment program specified herein.

1.22 ACCIDENT REPORTING

- .1 Investigate and report incidents and accidents as outlined in Provincial Occupational Safety and Health Act and Regulations.
- .2 Investigate and immediately report to Departmental Representative incidents and accidents which results, or has the potential of resulting in:
 - .1 Injuries requiring medical aid.
 - .2 Property damage in excess of \$5,000.00.
 - .3 Required notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable regulations.

1.23 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 REFERENCES

.1 Definitions:

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Erosion: A combination of processes in which materials of the earth's surface are loosened, dissolved, or worn away, and transported from one place to another by natural agents.
- .3 Sedimentation: The addition of soils to water bodies by natural and human related activities.
- .4 Storm Water Runoff: Precipitation that does not soak into the ground or evaporate, but flows along the ground surface as runoff.
- .5 Erosion and Sediment Control Plan: Plan identifying the applicable stabilization and structural strategies that shall be employed to limit sediment and erosion during construction.
- .6 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water and air; biological and cultural resources; and includes management of visual aesthetics, noise, solid, chemical, gaseous and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .7 Deleterious Substance: defined by the Fisheries Act as any substance that, if added to water, makes the water deleterious to fish or fish habitat or any water containing a substance in such quantity or concentration or has been changed by heat or other means, that if added to water makes that water deleterious to fish or fish habitat.
- .8 Contaminant: means any solid, liquid, gas, micro-organism, odour, heat, sound, vibration, radiation or combination of any of them, present in the environment.
- .9 Contaminants and Deleterious substances includes, but are not limited to: sediment or sediment-laden water, petroleum products, paints, thinners, heated water, concrete wash water, salt, heavy metals, wood preservatives, cleaning supplies, pesticides, wood and food waste, and fecal matter.
- .10 Environmental incidents or emergencies include:
 - .1 Chemical or Petroleum spills;
 - .2 Poisonous or Caustic Gas Emission;
 - .3 Biological or Chemical Explosion;
 - .4 Hazardous Material Spill;
 - .5 Sewage Spill;
 - .6 Contaminated Water into Waterways;

.7 Explosion and Ammunition.

.2 Reference Standards:

- .1 Parks Canada National Best Management Practices – Roadway, Highway, Parkway and Related Infrastructure.
 - .1 Document is included in Technical Specifications as Appendix B.
- .2 Parks Canada Basic Impact Analysis (BIA) for the project as Appendix C.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to the pre-construction meeting, submit Environmental Protection Plan for review and approval by Departmental Representative.
- .3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Include in Environmental Protection Plan:
 - .1 Name of person responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name and qualifications of person responsible for manifesting hazardous waste to be removed from site.
 - .3 Name and qualifications of person 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.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
 - .8 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 and methods for protection of features to be preserved within authorized work areas.
 - .9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

- .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .12 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.
- .13 Waste Water Management Plan identifying methods and procedures for management discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water and dewatering of ground water.
- .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

1.3 SENSITIVE AREAS

- .1 Site clearing, ground disturbance, and heavy equipment traffic shall not occur within Sensitive Areas unless absolutely required and authorized by Departmental Representative.
- .2 Contractors must make all efforts to prevent contaminants and deleterious substances arising from their work from directly or indirectly entering those areas indicated as sensitive areas on drawings (e.g. watercourses and wetlands). This may include mitigative measures such as altering; work schedules, methods of undertaking the work, materials used, and installation of mitigative structures (e.g. sediment control fence, check dams, mulching, etc.).
- .3 Failure to comply can lead to charges under various legislation, including the federal Fisheries Act, Parks Canada Act, and the Newfoundland and Labrador Environmental Protection Act.

1.4 FIRES

- .1 Fires and burning of rubbish on site is not permitted.
- .2 Immediately report all fires to the Departmental Representative. The Contractor is held responsible to make all reasonable efforts to extinguish any fires on the site.
- .3 The Contractor is required to comply with the Fire Protection Regulations of the National Parks Act.
- .4 In accordance with these Regulations, the Park Superintendent may restrict activities, or access to work areas, in the interest of fire prevention.
- .5 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.
- .6 Vehicles and stationary equipment must be equipped with fire suppression equipment such as an operable fire extinguisher.
- .7 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.

1.5 DISPOSAL OF WASTES

- .1 Littering is prohibited.
- .2 Dispose of rubbish and waste materials at authorized site.
- .3 Do not dispose of waste, volatile or deleterious materials into waterways, wetlands, storm or sanitary sewers.
- .4 All refuse from demolition is the property of the Contractor and shall be removed and disposed of in a legal manner.
- .5 All Hazardous materials shall be sealed as dictated by authorities having jurisdiction, and disposed of off-site, unless otherwise instructed by the Departmental Representative.
- .6 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).

1.6 DRAINAGE

- .1 Provide temporary drainage and pumping required to keep excavations and site free from water, as specified on the Drawings and in Section 31 23 33.01 Excavating, Trenching and Backfilling.
- .2 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas designated by Departmental Representative.

1.8 WORK ADJACENT TO WETLANDS AND WATERCOURSES

- .1 Construction equipment to be operated on land only.
- .2 Use of borrow material from watercourses or wetlands is prohibited.
- .3 Do not alter or draw any water from a watercourse or wetland without first obtaining necessary permits or approvals.
- .4 Do not dump excavated fill, waste material or debris in watercourses or wetlands.

- .5 Design and construct temporary crossings to minimize erosion to watercourse or wetland. All temporary crossings must be pre-approved by Departmental Representative prior to construction.
- .6 Do not skid logs or construction materials across watercourses or wetland.
- .7 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .8 Do not blast under watercourses or wetland within 100 m of spawning beds without obtaining necessary permits or approvals.
- .9 Provide a buffer zone in combination with appropriate erosion and sedimentation control when working adjacent to watercourses and wetlands. Consult with regulatory agencies.

1.9 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 Prior to the pre-construction meeting, prepare an Environmental Protection Plan, which addresses procedures to follow in the event of a pollution incident and ensure all staff are aware of these procedures. Provide copy of contingency plan to the Departmental Representative.
- .4 Maintain temporary erosion and pollution control devices installed under this contract until the Work is completed as specified in the Project Documents.
- .5 Remove temporary erosion and pollution control measures just prior to project completion unless directed otherwise. Chemicals used in dust control must have prior approval of the Departmental Representative.
- .6 Control emissions from equipment to requirement of authority having jurisdiction.
- .7 Provide temporary enclosures to protect environment from effects of abrasive blasting.
- .8 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .9 Keep paved surfaces clean. Control dust by application of calcium chloride or water.

1.10 PETROLEUM, OIL AND LUBRICANT STORAGE

- .1 Take precautions to avoid contamination of the site from Petroleum, Oil and Lubricants (POL's).
- .2 The management of POL's and chemicals must meet with the requirements of the Newfoundland and Labrador Dangerous Goods Transportation Act and all other appropriate provincial and federal regulations to include but not be limited to the following:
 - .1 Temporary POL storage sites are to be located a minimum 200 m from any watercourse or wetland.
 - .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 The Departmental Representative 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.
- .4 Storage of large amounts of fuel (more than 900 L) in the Park is not permitted.
- .5 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.

1.11 REFUELING AND SPILL CONTAINMENT

- .1 Take precautions to avoid contamination of the site from fuel. Keep and maintain hydrocarbon containment and cleanup materials on site for the duration of construction activities. Ensure that Contractor's personnel are trained in the proper use of such materials.
- .2 Establish suitable fueling and maintenance areas and obtain approval from the Departmental Representative.
- .3 Do not refuel or maintain equipment adjacent to or within 100 meters of any watercourse or sensitive areas.
- .4 Monitor on site vehicles for fluid leaks. Implement a preventative maintenance program to keep vehicles free from leaks.
- .5 Refueling 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 Departmental Representative consent. The Contractor must submit plans for fuel management and a Spill Contingency Plan seven days prior to the start of the Work. The Contractor is expected to be prepared to effect the containment and clean-up of all spills related to the Work.
- .6 Emulsion storage tanker and transfer of emulsion from tanker to spray vehicle are not permitted within National Park.

1.12 EQUIPMENT MOVEMENT AND MAINTENANCE

- .1 Maintenance work on Contractor/Sub-Contractor equipment is prohibited within National Park.
- .2 Waste oil and solvents are to be properly contained until they are removed from the site by qualified companies for recycling or disposal.
- .3 Any leaking equipment must be taken out of service until repaired.
- .4 Limit the number and length of temporary access and construction roads.

1.13 AIRBORNE POLLUTION AND PARTICULATE CONTROL

- .1 Keep dust and inconvenience to site occupants to a minimum.
- .2 Control emissions from equipment to local emission requirements.
- .3 Do grading activities to minimize dusting. Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.14 NOISE CONTROL

- .1 Operate construction equipment to prevent excessive noise.
- .2 To reduce potential negative impacts on Park fauna, noise control measures, such as properly functioning mufflers on equipment, must be in place.

1.15 BLASTING

- .1 Blasting is prohibited.

1.16 SEWAGE DISPOSAL

- .1 Provide and maintain temporary sanitary facilities for site personnel.
- .2 Obtain all approvals required for the disposal of sanitary waste from any facilities, including offices, washrooms, and temporary site trailers.
- .3 Remove sanitary facilities from site when no longer required.

1.17 FISHERIES AND WILDLIFE

- .1 Wildlife shall not be fed or harassed.
- .2 All refuse shall be disposed of at an approved facility to avoid the attraction of nuisance animals.
- .3 In case of persistent wildlife encounters, the Contractor shall inform the Departmental Representative, who will notify Parks Canada of the situation. Care shall be taken to avoid the animal.
- .4 All observed fish shall be removed from the isolated reach of the channel prior to dewatering operations. Fish removal can only be performed by GMNP's Resource Conservation Division. PCA shall not be financially responsible for any time delays for fish removal. Contractor shall inform PCA at least seven (7) days in advance of any necessary removal.

1.18 UNFORESEEN SITE STOPPAGES

- .1 If contaminated sites, heritage sites, archeological resources, or other unforeseen site conditions are encountered in the work site area, work will immediately cease until investigations are completed and permission to continue is granted from the Departmental Representative.

1.19 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.

1.20 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.

1.21 MEASUREMENT FOR PAYMENT

- .1 See Section 01 29 00 – Payment Procedures.

Part 2 Products

2.1 SEDIMENT CONTROL FENCE

- .1 Provide and maintain sediment control fence where required or as directed, prior to construction. Coordinate locations with Departmental Representative. Do not remove control features until authorized by the Departmental Representative.
- .2 Sediment Control fence: preassembled sediment control fence with industrial woven geotextile fabric (Type W1) pre-stapled to wood posts spaced as indicated.

2.2 EROSION CONTROL STRUCTURES

- .1 Provide and maintain erosion control structures where required or as directed, prior to construction. Coordinate locations with Departmental Representative. Do not remove control features until authorized by the Departmental Representative.
- .2 Geotextile: non-woven, needle-punched polyester filter fabric (Type N1).
- .3 Random rip-rap shall be supplied in accordance with Section 31 37 00 – Rip-rap.
- .4 Construct erosion control structures to the cross sections indicated on the Project Documents.

Part 3 Execution

3.1 SEDIMENT CONTROL

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.
- .2 The Contractor shall install additional sediment control fence as directed by the Contractor's on-site environmental representative, as well as per applicable permits and regulations.

- .3 The sediment control fence shall be installed as indicated on the Contract Documents and prefabricated sediment control fence shall be installed as per the manufacturer's instructions.
 - .1 In areas of potential sheet flow runoff where construction activity may cause the drainage run-off to transport sediment(s), and the Contract Documents do not provide for sediment control fences in these areas, the Contractor shall ensure that sediment control fences are properly located in effective runoff control.
- .4 The Contractor shall maintain the sediment control fence in a functional condition continuously from the time of installation until the completion of the Contract or removal.
- .5 The Contractor shall inspect all sediment control fences after each rainfall and at least daily during periods of prolonged rainfall.
- .6 The Contractor shall immediately repair any damage to sediment control fences or parts thereof.
- .7 The Contractor shall remove retained sediment prior to it having accumulated to a level approximately but not exceeding one-half the height of the fence, and this sediment shall be disposed of at a location at least 30m from any watercourse, and in such manner that the sediment will not be returned to the Work Area or the watercourse; or
 - .1 Subject to the approval of the Departmental Representative, the Contractor may install a second, back-up sediment control fence, at his/her expense.
- .8 The Contractor shall remove all sediment control fence and the time of such removal shall be subject to the Departmental Representative approval but in all cases shall occur prior to the completion of the Contract.
 - .1 Sediment control fence removed shall become property of the Contractor and shall be disposed of outside of the Work Site.
 - .2 If the Departmental Representative notified the Contractor in writing, prior to the completion of the Contract, that all or any part of the sediment control fence is to remain in place, the Contractor shall be deemed to have completed her/his obligations for that portion of the sediment control fence under his Item and the sediment control fence shall become the property of the Owner.
- .9 At the time of removal, the Contractor shall excavate any remaining sediment and dispose of it at a location at least 30m from any watercourse, and in such manner that the sediment will not be returned to the Work Area or the watercourse and shall dress and seed the area of the removed fence and sedimentation, to the satisfaction of the Departmental Representative.

3.2 EROSION CONTROL

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.
- .2 The Contractor shall install additional erosion control structures as directed by the Contractor's on-site environmental representative, as well as per applicable permits and regulations.
- .3 Erosion control structures shall be constructed as indicated on Contract Documents.

- .4 Erosion control structures may be installed in natural swales prior to ditch construction, in temporary or partially constructed ditches, and/or in completed ditches.
 - .1 In areas of potential sheet flow runoff where construction activity may cause the drainage run-off to transport sediment, and the Contract Documents do not provide for erosion control structures in these areas, the Contractor shall ensure that erosion control structures are properly located for effective runoff control.
- .5 The Contractor shall carry out the Work in accordance with Contract Documents.
- .6 The application, construction details and clean-out requirements for different types of erosion control structures shall be carried out as indicated in Table 1.4.1 and Clause 1.4.7.

Table 1.4.1
Erosion Control Structures

Type	Application	Clean-Out Requirements
“A”	Type A structures shall be installed as spillways of dykes that are built to pond runoff from ditches or from grubbed areas, or at the end of a cut where runoff leaves the ditch to flow down a natural slope.	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point within 300mm of the crest of the spillway.
“B”	Type B structures are typically installed in rock ditches where stakes required for Type C and D structures cannot be driven.	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point within 100mm of the crest of the notch.
“C”	Type C structures are typically installed in earth ditches or swales.	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point of 100mm of the crest of the notch.
“D”	Type D structures are typically installed in earth ditches or swales.	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point of 100mm of the crest of the notch.

- .7 Clean-out consists of removal of sediment deposits retained by the structure and disposal of the removed materials in accordance with Clause 1.4.11.
 - .1 Sediment removal shall be performed so as to cause minimal disturbance to the ground or any part of the erosion control structure, and in the case of Type A structures, to the sediment pond dyke.
- .8 The Contractor shall maintain erosion control structure(s) in a functional condition from the time of installation until their removal.
 - .1 All erosion control structures shall be kept in place until the grass on hydroseeded slopes and ditches is stabilized as an effective erosion deterrent, or as directed by the departmental representative.

- .1 In Work Areas that are hydroseeded up to but no later than September 15th, erosion control structures Types B, C, and D shall be kept in place until the day on which the ground is prepared for hydroseeding, as approved by the Departmental Representative.
- .2 All erosion control structure(s) shall be removed as follow:
 - .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.
- .2 Scheduling of the removal of the erosion control structures shall be subject to the approval of the Departmental Representative.
 - .1 Erosion control structures removed shall become property of the Contractor and shall be disposed of outside of the Work Site.
 - .2 If the Departmental Representative notified the Contractor in writing, prior to the completion of the Contract, that all or any of the erosion control structure(s) are to remain in place, the Contractor shall be deemed to have completed his/her obligations for the portion of the Work under this Item and the erosion control structure(s) indicated shall become the property of the Owner.
- .3 At the time of the removal the Contractor shall excavate any remaining sediment and dispose of it at a location at least 30m from any watercourse, and in such manner that the sediment will not be returned to the Work Area or the watercourse.
- .4 The Contractor is to ensure that all possible care is taken to ensure that ground disturbance is maintained at a minimum during the erosion control structure removal operation and that all necessary precaution is taken to ensure that no sediment release occurs as a result of this removal activity.
- .5 The Contractor shall be responsible to match the affected ditches and Slopes with the Slopes and ditch grades of the adjacent Work Area(s).
- .6 The Contractor shall restore the area of the removed erosion control structure, deposited sedimentation and other disturbed ground within the Work Area, to the satisfaction of the Departmental Representative within 48 hours following the removal of the erosion control structure.
- .9 The Contractor shall inspect all erosion control structure(s) after each rainfall and at least daily during periods of prolonged rainfall.
- .10 The Contractor shall immediately repair any damage to erosion control structure(s) or parts thereof.
- .11 The Contractor shall dispose of the excavated sediment at a location, at least 30m away from any watercourse, and in such manner that the sediment will not be returned to the Work Area or watercourse.
- .12 The Contractor shall not remove any erosion control structure without the authorization of the Departmental Representative.

3.3 CLEANING

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

- .1 Leave Work area clean at end of each day.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 Cast in Place Concrete
- .2 Section 03 60 10.02 Controlled Low Strength Material
- .3 Section 33 42 13.01 Sealing of Culvert Joints

1.2 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection

1.4 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in 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 to store and cure test samples.

1.6 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If, in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner 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.

1.7 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested.

1.8 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.

1.9 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 ACTION AND INFORMATIONAL SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.3 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, platforms and temporary stairs as required.

1.4 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 to be operated by qualified operator.

1.5 SITE STORAGE / LOADING

- .1 Contractor's use of site storage and loading shall be limited to an area within limits of traffic diversion. Any conditional areas required shall be approved by Departmental Representative prior to use.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.6 CONSTRUCTION PARKING

- .1 Parking will be permitted in the area of the site provided it does not disrupt performance of Work and after obtaining agreement with the Departmental Representative.
- .2 Provide and maintain adequate access to project site.
- .3 Keep parking areas clean and maintained during period of Contract.

1.7 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.

1.8 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.

1.9 CONSTRUCTION SIGNAGE

- .1 No other signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction in both official languages graphic symbols to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.

1.10 PROTECTION AND MAINTENANCE OF TRAFFIC

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

1.11 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .3 Clean dirt or mud tracked onto paved or surfaced roadways.
- .4 Store materials resulting from demolition activities that are salvageable.

1.12 MEASUREMENT FOR PAYMENT

- .1 See Section 01 29 00 – Payment Procedures.

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 ACTION AND INFORMATIONAL SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

1.3 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.
- .2 Provide as required by governing authorities and as directed.

1.4 ACCESS TO SITE

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

1.5 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent Traffic Control Persons, traffic control signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
- .2 Traffic Control Persons must be certified by Workplace NL.

1.6 FIRE ROUTES

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

1.7 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.8 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 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.
- .4 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.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.2 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 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 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions.

1.3 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.
- .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.

1.4 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 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .5 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.

1.6 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.

1.7 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.

1.8 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

1.9 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.

1.10 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, and 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.

1.11 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 PROJECT CLEANLINESS

- .1 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.
- .2 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .3 Provide on-site containers for collection of waste materials and debris.
- .4 Dispose of waste materials and debris off site.
- .5 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .6 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .7 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .8 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

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

1.3 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING DURING CONSTRUCTION

- .1 The Contractor shall ensure that adequate dust control is provided at all times during the Contract to avoid any hazardous situations and shall immediately implement any measures as directed by the Departmental Representative to control dust problems. Any damages or costs incurred as a result of excessive dust shall be paid for by the Contractor.
- .2 There is some debris to be cleaned out of the in-stream culverts at Cobblers Brook and Platters Cove as described in 01 11 00 Summary of Work. The Contractor should confirm the extents of the debris to be cleaned with the Departmental Representative.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .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 to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .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 Certificates required by jurisdictional authorities have been submitted.
 - .4 Work is complete and ready for Final Inspection.
 - .3 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.2 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, 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.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.

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

1.3 RECORD DRAWINGS

- .1 Departmental Representative will provide two sets of white prints for record drawing purposes.
- .2 Maintain project record drawings and record accurately deviations from Contract documents.
- .3 Record changes in red. Mark on one set of prints and at completion of project and prior to final inspection, neatly transfer notations to second set and submit both sets to the Departmental Representative.
- .4 Record following information:
- .1 Field changes of dimension, detail and elevation.
 - .2 Changes made by Change Order or Field Order.
 - .3 Other significant deviations which are concealed in construction and cannot be identified by visual inspection
- .5 At completion of project and prior to final inspection, neatly transfer “as-recorded” records to second set of white prints using fine, red marker. Neatly print lettering and numbers in size to match original. Lines may be drawn free-hand but shall be neat and accurate. Add at each drawing title block note: “AS-RECORDED”. Also, circle on List of Drawings each title and number of drawing marked with “as-recorded” records.
- .6 Submit this set of “as-recorded” drawings to Departmental Representative.
- .7 At the completion of construction, the Contractor shall complete a topographic as-recorded survey of the project areas and submit the survey data in an acceptable form to the Departmental Representative.
- .8 If project is completed without significant deviations from contract drawings, declare this in writing and submit to Departmental Representative in lieu of record drawings.
- .9 The Departmental Representative will review the progress of the record drawings as part of each payment certificate authorization. Should the drawings not be properly updated, payment will be withheld for each payment certificate until the work is completed to the satisfaction of the Departmental Representative.
- .10 Provide digital photos, if requested, for site records.
- .11 Contract Drawings and shop drawings: mark each item to record actual construction, including:
- .1 Measured depths of elements of foundation in relation to finish road elevation.
 - .2 Measured horizontal and vertical locations of underground utilities, guiderail and appurtenances, referenced to permanent surface improvements.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by change orders.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.

1.4 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

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 33 00 Submittal Procedures
- .2 Section 01 74 11 Cleaning
- .3 Section 03 20 00 Concrete Reinforcing
- .4 Section 03 30 00 Cast-in-Place Concrete

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 The measurement and payment procedure for this section shall meet the requirements in Section 01 29 00 - Payment Procedures.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-O325-07(R2012), Construction Sheathing.
 - .3 CAN/CSA-S269.1-1975 (R2003), Falsework for Construction Purposes.
 - .4 CAN/CSA-S269.3-M92(R2013), Concrete Form- work, National Standard of Canada.

1.4 ACTION AND INFORMATION 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 a Professional Engineer registered or licensed in the Province of Newfoundland and Labrador, 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 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.

1.5 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 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 25mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs (applied before concrete sealers and costings 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 Release Agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms. Form release agents must be compatible with waterproofing systems where applicable.
 - .4 Falsework Materials: to CSA S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centers before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 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.
- .6 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .7 Use 25 mm chamfer strips on external corners and/or 25mm fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Construct forms for architectural concrete as indicated.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .10 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 painting.
 - .2 Anchors and inserts cast into the concrete shall either be isolated from dissimilar metals by either a 30mm clear spacing or denso tape barrier on the formwork anchors/inserts.
- .11 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 the following minimum periods of time after placing concrete:
 - .1 Four (4) days for concrete collars.
- .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 (7) days after the concrete placement.
- .6 Reuse 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

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Payment for this item shall be included in the contract unit price, per cubic meter, for Cast-in-Place Concrete.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, 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-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 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 Quantities of reinforcement.
 - .3 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.
 - .4 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .3 Detail lap lengths and bar development lengths to CSA-S6-14, unless otherwise indicated.
 - .1 Provide Class B tension lap splices unless otherwise indicated.

1.5 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 four (4) weeks prior to beginning reinforcing work.
 - .2 Upon request, submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer’s written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer’s name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer’s recommendations in clean, dry, well-ventilated areas.
 - .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 with a minimum zinc coating of 610 g/m² permitted after coating. All minor damage to the galvanizing shall be touched up with organic zinc paint.
- .4 Cold-drawn Annealed Steel Wire Ties: to ASTM A497/ A497M. 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 50mm of exposed faces, or be comprised of an acceptable non-metallic material to avoid galvanic reaction with galvanized repair/damage to galvanized coating.
- .5 Chairs, bolsters, bar supports, spacers: to CSA A23.1/ A23.2.
- .6 Anchor Bolts and Pilaster Cap Dowels: to ASTM A307 (or better). Anchor bolts and pilaster cap dowels to be galvanized as per this specification.

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 four (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 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 or 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, apply slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcement 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 pour.
- .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 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; ie., steel girder top flange studs) with a clear space of at least 30mm, 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

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 01 29 00 Payment Procedures
- .2 Section 01 33 00 Submittal Procedures
- .3 Section 01 45 00 Quality Control
- .4 Section 03 10 00 Concrete Forming and Accessories
- .5 Section 03 20 00 Concrete Reinforcing

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 The measurement and payment procedure for this section shall meet the requirements in Section 01 29 00 - Payment Procedures.

1.3 REFERENCES

- .1 ACI-211.1-91, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
- .2 ASTM A615/A615M-12, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- .3 ASTM C260, Standard Specification for Air- Entraining Admixtures for Concrete.
- .4 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
- .5 Canadian Standards Association (CSA International):
 - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium.
 - .4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

1.4 ABBREVIATIONS AND ACRONYMS

- .1 Cement: hydraulic cement or blended hydraulic cement (GU_b – where b denotes blended).
 - .1 Type GU or GU_b – General use cement.
- .2 Fly Ash:
 - .1 Type F – with CaO content less than 8%.
 - .2 Type CI – with CaO content ranging from 8 to 20%.
 - .3 Type CH – with CaO greater than 20%.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit copies of WHMIS MSDS, Material Safety Data Sheets.
- .3 Provide certification indicating the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Program or equivalent.

- .4 Provide mix design in compliance with CSA-A23.1 to provide concrete of quality, yield and strength specified under 2.2 Mix Design. Mix design to be prepared by and stamped by an engineer licensed to practice in the Province of Newfoundland and Labrador.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.
- .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with 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 and mix designs used in concrete mixture will meet specified requirements.
- .3 At least 4 weeks prior to beginning Work, inform Consultant and source of fly ash.
 - .1 Changing source of fly ash without written approval of the Consultant is prohibited.
- .4 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on the following items:
 - .1 Falsework erection;
 - .2 Hot weather concrete;
 - .3 Cold weather concrete;
 - .4 Curing;
 - .5 Finishes;
 - .6 Formwork removal;
 - .7 Joints.
- .5 Health and Safety Requirements: Do construction occupational health and safety requirements in accordance with Section 01 35 29 – Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete Hauling Time: deliver to site of work and discharge within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
 - .2 Concrete Delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.8 SITE CONDITIONS

- .1 Placing concrete during rain or weather events that could damage concrete is prohibited.
- .2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.
- .3 Cold weather protection:
 - .1 Maintain protection equipment, in readiness on Site.

- .2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.
- .4 Hot weather protection:
 - .1 Protect concrete from direct sunlight when ambient temperature above 27°C.
 - .2 Prevent forms from getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.
- .5 Protect from drying.

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CSA A3001, Type GUb
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 Admixtures:
 - .1 Air Entraining Admixture: to ASTM C260.
 - .2 Chemical Admixture: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .3 Obtain authorization from the Departmental Representative for use of super plasticizing admixture, water reducer, and/or other admixtures as approved by the Departmental Representative to achieve designed concrete properties.
- .5 Chemical Adhesive Anchoring System: Hilti RE500 Chemical Adhesive Anchoring System or approved equivalent.

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 35 MPa in 28 days. 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.
- .3 Proportion normal density concrete in accordance with CAN/CSA-A23.1. Concrete mixtures shall be designed to meet the following:
 - .1 Minimum Compressive Strength at 28 days: 35 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: 20mm.
 - .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 super- plasticizer).
 - .9 Maximum Slump before Superplasticizer: 60 mm.

- .10 Slumps after Superplasticizer: 180 +/- 30 mm.
- .11 Maximum spacing factor of hardened concrete not to exceed 230 Φ m.
- .12 Chloride Ion Permeability @ 56 days: <1000 coulombs.
- .13 Maximum Concrete Temperature (from delivery equipment):
 - .1 Thickness >2 meters: 18°C.
 - .2 Thickness <2 meters: 25°C.
- .14 Maximum Concrete Temperature (in situ): 70°C.
- .15 Maximum Temperature Gradient: 20°C/meter.
- .16 Superplasticizer shall be used in all concrete.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 48 hours minimum notice prior to placing of concrete.
 - .2 High performance concrete shall not be placed when the air temperature exceeds 25 degrees C or is likely to rise above.
- .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 facilities placing with minimum of re-handling and without damage to existing structure or work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .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 in adverse weather.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .9 Do not place load upon new concrete until authorized by Departmental Representative.
- .10 Apply bonding agent to all existing concrete surfaces in accordance with manufacturer's instructions prior to the placement of new concrete.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and Inserts:

- .1 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .2 Sleeves and openings greater than 100x100mm not indicated, must be reviewed by Departmental Representative.
 - .3 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.
 - .4 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor Bolts:
- .1 Set anchor bolts to templates in coordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .5 Finishing and Curing:
- .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct tests as follows in accordance with Section 01 45 00 – Quality Control and submit report as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours
 - .2 Slump
 - .3 Air content
 - .4 Compressive strength at 7, 28 and 56 days.
- .2 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.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Owner will pay for costs of tests as specified in Section 01 29 83 – Payment Procedures for Testing Laboratory Services.

- .4 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Inspection or testing by Owner will not augment or replace Contractor quality control, nor relieve Contractor of his contractual responsibility.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – 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 01 45 00 Quality Control
- .3 Section 03 30 00 Cast-in-Place Concrete
- .4 Section 33 42 13.01 Sealing of Culvert Joints

1.2 MEASUREMENTS AND PAYMENTS

- .1 Measurement Procedures: in accordance with Section [01 29 00- Payment Procedures].
- .2 All measurements to be verified by Departmental Representative.
 - .1 Mixing and injecting Controlled Low Strength Material (CLSM), including all costs of labour, plant, equipment, and the cost of water for the mixes: per cubic metre.
- .3 The Payments for CLSM will be paid for by unit cost for the amount of materials placed during the work.
- .4 Unless specified otherwise, all necessary work for the completion of CLSM injections will not be measured separately for payment, but will be considered as incidental to the work upon the authorization of Departmental Representative. Such work includes, but is not limited to: inspecting and sealing joints, cracks and voids prior to and during injection of CLSM.

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Site Visit: schedule a site visit with the Departmental Representative to examine existing site conditions and to verify conditions and repair work as required before grouting work starts.

1.4 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 230/C 230M-[14], Standard Specification for Flow Table for Use in Tests of Hydraulic Cement
 - .2 ASTM C 496/C 496M-[17] Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
- .2 CSA Group (CSA)
 - .1 CSA A23.1/A23.2-[14], Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete

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

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section [01 33 00- Submittal Procedures].
- .2 Submit copies of WHMIS MSDS, Material Safety Data Sheets.
- .3 The Contractor shall submit the name of the proposed Ready Mix Supplier for approval of the Engineer 4 days in advance of supplying any CLSM to the Work, and this submittal shall consist of but is not limited to:
 - .1 Proof that the CLSM supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Plant Certification Program or equivalent, in the appropriate categories per CSA A23.1.
 - .2 Only CLSM supplied from certified plants shall be acceptable for use.
- .4 The Contractor shall submit the mix design for CLSM 5 Days in advance of supplying CLSM for the Work. The CLSM mix design submittal shall include all data sheets for proprietary products, equipment, and admixtures utilized in the CLSM mix design and proportioning.
- .5 The Contractor shall submit a Quality Control (QC) plan 5 days in advance of supplying CLSM for the work. The QC plan must include all aspects of the work associated with the batching, supply, and placement of the CLSM. The QC plan shall include a detailed method of monitoring and control of the density of the CLSM at the point of discharge.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.
- .2 Provide Departmental Representative, minimum 4 weeks prior to starting CLSM work, with valid and recognized certificate from plant delivering CLSM.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in CLSM mixture will meet specified requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 CLSM Hauling Time: deliver to site of work and discharge within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and CLSM producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

.2 CLSM Delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.8 SITE CONDITIONS

.1 Placing CLSM during rain or weather events that could damage CLSM is prohibited.

.2 Protect newly placed CLSM from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before CLSM cured.

.4 Hot weather protection:

.1 Protect CLSM from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms from getting too hot before CLSM placed. Apply accepted methods of cooling not to affect CLSM adversely.

.5 Protect from drying.

Part 2 Products

2.1 MATERIALS

.1 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

.1 This Item consists of the design, proportioning, supply and placement of controlled low-strength material (CLSM) to fill voids behind the culvert walls and under existing cut-off walls.

.2 All materials shall be supplied by the Contractor.

.3 Material properties shall conform to CSA A23.1 unless otherwise specified herein.

- .4 Cementing materials shall conform to CSA A3001 as follows:

Cementing Material	Type of Cement
Hydraulic cement	Type GU
Blended hydraulic cement	Type GUB
Supplementary cementing materials	Types F, S and SF

- .5 The CLSM shall be Low Density Cellular Concrete Fill, or Engineer Approved Equivalent. Guidance Can be found in ACI 229R and ACI 523.1R.
- .6 Other admixtures not covered by ASTM shall require approval of the Engineer prior to use and shall conform to the manufacturer's recommendations or as otherwise submitted with the mix design.
- .8 The CLSM shall be capable of being pumped and have high flowability with no segregation or subsidence.
- .9 The maximum percentage passing the 80 µm sieve shall not exceed 9%.
- .10 The Portland cement content shall be 25 kg/m³.
- .11 The slump at point of discharge shall be minimum 150 mm.
- .12 The specified compressive strength at 28 days shall be maximum 1.0 MPa.
- .13 The use of fly ash, in addition to the noted Portland cement content, may be used in such proportion so as not to exceed the specified compressive strength.
- .14 Coarse aggregates, if used in the mixture, are exempt from evaluation for contribution to alkali aggregate reactivity (AAR).

2.2 EQUIPMENT

- .1 Submit a list of equipment to be on site to Departmental Representative.
- .2 Obtain the approval of Departmental Representative for equipment used for mixing and injecting CLSM.
- .3 Maintain injection equipment and ensure equipment is in good operating order.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing CLSM.
- .1 Provide 48 hours minimum notice prior to placing of CLSM.

- .2 During concreting operations:
 - .1 Ensure CLSM delivery and handling facilities placing with minimum of re-handling and without damage to existing structure or work.
- .4 Pumping of CLSM is permitted only after approval of equipment and mix.
- .5 Prior to placing of CLSM, obtain Departmental Representative's approval of proposed method for protection of CLSM during placing and curing in adverse weather.
- .6 Maintain accurate records of poured CLSM items to indicate date, location of pour, quality, air temperature and test samples taken.
- .7 Do not place load upon new CLSM until authorized by Departmental Representative.

3.2 INSTALLATION

- .1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.
- .2 All CLSM materials shall be handled and protected in such a way as to prevent segregation, damage, and contamination.
- .3 All cement, aggregate, and other CLSM construction materials shall be stored in accordance with CSA A3001 and CSA A23.1.
- .4 Handling, mixing, and installation of the CLSM shall be in accordance with the manufacturer's recommended procedures and specifications.
- .5 CLSM shall be proportioned in accordance with the submitted mix design.
- .6 CLSM delivery shall be regulated to enable continuous deposition until placement in each section of the Work is completed.
- .7 The Contractor shall verify that CLSM has completely filled all voids and gaps specified.
 - .1 Incomplete filling of voids or gaps noted in the contract documents shall be corrected by the Contractor at the Contractor's expense.
 - .2 A corrective action plan shall be submitted to the Engineer for approval.
 - .3 A corrective action plan shall be submitted to the Engineer for approval.
 - .4 Excessive subsistence shall be corrected by the Contractor at the Contractor's Expense.
 - .5 The Owner reserves the right to obtain and test samples at any time and/or location, without notice, for any reason.

3.3 SURFACE REPAIRS

- .1 Seal leaks using fast setting cement and/or oakum or other means of plugging undesired leaks during injection.
- .2 Install repair material in accordance with manufacturer's instructions.
- .3 Restore disturbed surfaces to original profiles.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct tests as follows in accordance with Section 01 45 00 – Quality Control and submit report as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 CLSM inject
 - .2 Slump
 - .3 Air content
 - .4 Compressive strength at 7, 28 and 56 days.
- .2 Inspection and testing of CLSM and CLSM materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/ A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Owner will pay for costs of tests as specified in Section 01 29 83 – Payment Procedures for Testing Laboratory Services.
- .4 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as CLSM which they represent.
- .5 Inspection or testing by Owner will not augment or replace Contractor quality control, nor relieve Contractor of his contractual responsibility.
- .6 The Contractor shall carry out all testing of CLSM and shall submit all test results to the Engineer.
- .2 Testing of CLSM shall include:
 - .1 All testing indicated in the QC plan.
 - .2 28 day compressive strength test.
 - .3 Verification of hardening.

- .1 Hardness shall be verified by field measurements or by the results of field trials performed prior to the placement of CLSM. The results of the field trials shall be submitted to the Engineer for approval prior to any placement of CLSM.
- .4 Measure for any subsidence 48 hours after placement.
 - .1 Subsidence shall be verified by field measurements or by the results of field trials performed prior to the placement of CLSM. The results of the field trials shall be submitted to the Engineer for approval prior to any placement of CLSM.

3.5 CLEANING

- .1 Progress cleaning in accordance with Section 01 74 00- Cleaning.
- .2 Leave work area clean at the end of each working day.
- .3 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
- .4 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00- Cleaning].
- .6 Waste Management: separate waste materials for reuse and recycling.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect adjacent finished work against damage which may be caused by ongoing work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 45 00 Quality Control
- .3 Section 03 30 00 Cast-in-Place Concrete
- .4 Section 03 60 10.02 Controlled Low Strength Material (CLSM)

1.2 MEASUREMENT AND PAYMENT

- .1 Measurement Procedures: in accordance with Section [01 29 00- Payment Procedures].
- .2 Measurement of the sealing of culvert joints shall be per joint (each) including the supply and installation of the Mechanically Fastened Bands, mortar and all other items required for the sealing of the culvert joints. Unless specified otherwise, all necessary work for the completion of the sealing of culvert joints will not be measured separately for payment, and shall be considered incidental to Section 33 42 13.01.

1.3 REFERENCE STANDARDS

- .1 CSA Group (CSA
 .1 CAN/CSA G401-[07], Corrugated Steel Pipe Products.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 - Submittal Procedures].
- .2 Submit manufacturer's instructions, printed product literature and data sheets for the Sealing of Culvert Joints and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit injection plan for the injection of CLSM for review by Department Representative. Plan to include equipment to be utilized, port installation and port location.
- .4 Submit hydraulic cement mortar to department representative for approval prior to installation.

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 in accordance with manufacturer's recommendations.
 - .2 Store and protect items related to the Sealing of Culvert Joints from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 SEALING OF CULVERT JOINTS

- .1 All materials to be supplied by the contractor.
- .2 See section 03 65 00 for CLSM material requirements.
- .3 All reinforcing steel shall be hot dipped galvanized in accordance with CAN/CSA G-164-M with a minimum zinc coating of 610 g/m² permitted after coating. Any minor damages to the galvanizing shall be touched up with organic zinc paint.

Part 3 Execution

3.1 PREPARATION

- .1 Do not allow water to flow freely through pipes during all work related to the Sealing of the Culvert Joints. Prior to the commencement of the Sealing of the Culvert Joints, complete all required Temporary Water Control Works procedures in accordance with Section 31 23 33.01 and as directed by the Departmental Representative.
- .2 Culvert joints need to be cleaned and cleared of debris prior to installation to ensure adequate seal around the joint.

3.2 INSTALLATION

- .1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.

3.3 JOINT REPAIR

- .1 Use a 6mm galvanized metal band to connect joint edges as per construction drawings.
- .2 Rivet band in place using 6mm galvanized rivet (Huck, Pop or equivalent)
- .3 Seal band edges with hydraulic cement mortar (Sika 212HP or equivalent). Mortar to cure for a minimum of 24hrs prior to injection.
- .4 Install injection ports in the center of the band to intersect joint voids. Injection work to be completed in two phase to reduce the chance of blow outs. The bottom half of the joint to be filled and initially cured before the top half can be injected.
- .5 Department Representative shall inspect joints to confirm voids have been completely filled.

3.4 PROTECTION OF COMPLETED WORK

- .1 Round any sharp edges that remain after completion of the joint repairs.
- .2 Protect adjacent finished work against damage which may be caused by ongoing work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 45 00 Quality Control
- .3 Section 03 30 00 Cast-in-Place Concrete
- .4 Section 03 60 10.02 Controlled Low Strength Material (CLSM)
- .5 Section 33 42 13.01 Sealing of Culvert Joints

1.2 REFERENCES

- .1 Specifications Book, Newfoundland and Labrador Department of Transportation and Works.

1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation are recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .6 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM C136: Sieve sizes to CAN/CGSB-8.2.
 - .2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

- .7 Material definitions included herein are general in nature and may or may not be relevant to this project.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Preconstruction Submittals:
- .1 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field and clearance record from utility authority, as required.

1.5 EXISTING CONDITIONS

- .1 Buried services (as required):
- .1 Before commencing work, establish location of buried services on and adjacent to site.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
- .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .4 Prior to beginning excavation work, notify utility companies to establish location and state of use of buried utilities and structures. Utility companies to clearly mark such locations to prevent disturbance during work.
- .5 Confirm locations of buried utilities by careful test excavations.
- .6 Maintain and protect from damage, water, electric, telephone and other utilities and structures encountered.
- .7 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing. Costs for such work to be paid by Owner.
- .8 Record location of maintained, re-routed and abandoned underground lines.
- .9 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing surface features:
- .1 Conduct, with Departmental Representative, condition survey of existing trees and other plants, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by work.
- .2 Protect existing surface features from damage while work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
- .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

1.6 MEASUREMENT FOR PAYMENT

- .1 See Section 01 29 00 – Payment Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Backfill:
 - .1 Select material obtained from excavation. Existing rip rap may be required to be removed and replaced to allow adequate space for installation of reinforced concrete collars.

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 watercourses, according to requirements of authorities having jurisdiction and sediment and erosion control plan, specific to site, whichever is more stringent.
- .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 SITE PREPARATION

- .1 Remove obstructions from surfaces to be excavated within limits indicated.

3.3 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STOCKPILING

- .1 Stockpile fill materials and/or rip rap to be reused in areas designated by Departmental Representative.
- .2 Protect materials from moisture and contamination (as required).
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies and watercourses.

3.5 COFFERDAMS / TEMPORARY WATER CONTROL WORKS (TWCW)

- .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 Requirements and Occupational Health and Safety Act for the Province of Newfoundland and Labrador.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of watercourse.
- .3 Construct temporary works to depths, heights and locations as indicated on the Drawings and as approved by the Departmental Representative.
 - .1 As noted in section 01 11 00 Summary of Work and as indicated on the Drawings, in addition to cofferdam(s), a temporary water control pipe will be required to be inserted through the existing culvert at Platters Cove to provide the minimum required Temporary Water Control flow capacity.
 - .2 At Cobblers Brook alternate Temporary Water Control measures may be considered. An option may be to divert the flow to the north pipe. This should be confirmed by the Contractor and an appropriate temporary water control plan provided for approval by the Departmental Representative.
- .4 Upon completion of culvert rehabilitation Works:
 - .1 Remove cofferdams and temporary water control measures including temporary water control pipes;
 - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

3.6 DEWATERING AND HEAVE PROTECTION

- .1 Keep excavations and existing culvert structures free of water while work is in progress.
- .2 Provide for Departmental Representative's approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures 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.

3.7 EXCAVATION

- .1 Excavate existing Rip Rap and/ or embankment materials as required to be reused after installation of concrete collars, as shown on the Drawings.
- .2 Contractor to visit site to confirm existing conditions and extents of required excavation as needed to complete the cast-in place concrete work.

- .3 Excavation must not interfere with bearing capacity of adjacent foundations/ structures, or cause damage to existing structures.
- .4 Keep excavated and stockpiled materials safe distance away from edge of the excavation as directed by the Departmental Representative
- .5 Restrict vehicle operations directly adjacent to open excavations.
- .6 Dispose of surplus and unsuitable excavated material off site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Do not excavate without consultation with Departmental Representative. Additional care is required not to undermine existing culvert inlet and outlet. Excavation should be limited to removing excess material for ease of construction for cast-in-place collar.

3.8 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory material.
- .2 Backfilling around installations:
 - .1 Replace rip rap that was previously removed for cast-in place concrete work.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed work to equalize loading.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative.
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.

3.9 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace and/or regrade disturbed topsoil as required, as directed by Departmental Representative.
- .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.

- .5 Dispose of surplus material off-site, unless otherwise directed by the Contract Documents.

END OF SECTION

Part 1 General

1.1 REFERENCES STANDARDS

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M180, Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail.
- .2 ASTM International
 - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - .3 ASTM A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- .3 CSA International
 - .1 CAN/CSA O80 Series, Wood Preservation.
 - .2 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA S136, North American Specification for the Design of Cold-formed Steel Structural Members.
 - .4 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .4 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber.
- .5 American Wood Preservers' Association (AWPA)
- .6 Specifications Book, Newfoundland and Labrador Department of Transportation and Works.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for guide rail, wood, and coatings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit product name and manufacturer's specification for the preservative to be applied to the post field cuts and zinc-rich paint to repair minor damage to galvanized coating, and to coat cut ends and field drilled holes.
 - .3 Submit manufacturer's certification, for all galvanized metals, that the materials supplied meet the specified requirements.

1.3 DELIVERY, STORAGE AND HANDLING

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

1.4 MEASUREMENT FOR PAYMENT

- .1 See Section 01 29 00 – Payment Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Steel W-beam guide rail as indicated and as follows:
 - .1 Steel rail and terminal sections: manufactured from open hearth, electric furnace or basic oxygen semi-spring steel sheet and hot dip galvanized after fabrication.
 - .1 To AASHTO M180, class A Type 2 zinc coated.
 - .2 The steel beam shall be in accordance with the cross-section and dimensions as shown on the contract drawings.
 - .2 Rails shall be punched for splice and post bolts in strict conformity with the AASHTO Standard to the designated number and center-to-center spacing of posts. No punching, cutting or welding will be permitted on site.
 - .3 If any guide rail installation requires curved W-beam rails, the Contractor shall form these to the radius specified by the Departmental Representative prior to galvanizing.
 - .4 Each beam element shall be identified by the following marking in accordance with AASHTO M180:
 - .1 Name or brand of manufacturer,
 - .2 Identification symbols or code for heat,
 - .3 Number and coating lot,
 - .4 AASHTO specification number, and
 - .5 Class, type, and thickness
 - .5 The rails and terminal elements shall be manufactured according to the following standards:
 - .1 Mechanical properties of the base metal for the rails shall conform to the following requirements:
 - .1 Minimum Yield Point: 350 MPa

- .2 Minimum Tensile Strength: 483 MPa
- .3 Minimum Elongation: 12% in 50 mm length
- .2 Sheet thickness shall be in accordance with Table 2 (Class A, Type 2) of AASHTO Standard M180 of the latest edition, with a nominal base metal thickness of 2.82 mm (2.59 mm minimum).
- .6 Welding for the fabrication of terminal elements shall conform to the requirements of CSA-W59.
- .2 Hot Dip Galvanizing:
 - .1 Hot dip galvanized coating shall be smooth, free of beading or sharp projections at edges. Coating adherence shall prevent the peeling of any portion of the zinc coating so as to expose the base metal by cutting or prying with a stout knife under considerable pressure (bond check). A magnetic gauge will be used for checking thickness, in accordance with ASTM E316.3.
 - .2 Warped or otherwise deformed rails and terminal elements will be rejected, as will those with injurious defects or excessive roughness of the zinc coating. When the rail is laid on a flat surface, the warpage shall not be greater than 50 mm.
- .3 Posts and Offset Blocks as indicated and as follows:
 - .1 The acceptable species for guide rail posts and offset blocks shall be:
 - .1 Only birch wood will be acceptable for 150 x 150 guide rail posts and offset blocks.
 - .2 Hemlock or other approved species will be acceptable for 200 x 200 guide rail posts and offset blocks.
 - .2 The posts shall be sound and rot-free, and shall conform with the requirements for No. 1 Structural Posts and Timbers, graded in accordance with the National Lumber Grading Authority (NLGA) Standard Grading Rules for Canadian Lumber. Posts and offset blocks shall be subject to inspection by the Departmental Representative when the bundles are opened immediately prior to use.
 - .3 Prior to pressure-treating, posts and offset blocks shall be incised on all four sides and dried to their fibre saturation point of 25 to 30% at 25 mm depth.
 - .4 For pressure treating, preservative treatment of posts and offset blocks shall be chromated copper arsenate (CCA). For field cut surfaces, preservative shall be 2% copper naphthenate wood preservative, applied in two coats.
 - .5 Treatment shall be completed in accordance with requirements of CSA-080. The penetration and retention of preservatives shall conform to the requirements of CSA Standard O80.14, Table 1, Minimum Retention of Preservatives in Pressure Treated Wood for Highway Construction, under the headings "Post-Guardrail, Guide, Sign and Sight" for posts, and "Bridge Hand Rails, Guard Rails and Posts" (not in contact with ground or water). The Departmental Representative may verify the penetration and retention of the preservative by the assay method.

- .4 Bolts, Nuts, Washers and Spikes:
 - .1 All bolts, nuts and washers shall conform to ASTM A307 and shall be hot dip galvanized conforming to CAN/CSA G164.
 - .2 Post bolts and splice bolts shall have shoulders of such shape and size that they fit into the bolt slots in the rails and thus prevent the bolt from turning.
 - .3 Post bolts shall be 16mm diameter and 200mm long for use with standard 150mm x 150mm posts, or 16mm diameter and 250mm long for use with 200mm x 200mm posts.
 - .4 Post bolt washers for the back of posts shall be 45mm in diameter and 4mm thick.
 - .5 Bolts for anchors shall be 16mm diameter and 350mm long for use with standard 150mm x 150mm posts and anchors, or 16mm diameter and 450mm long for use with 200mm x 200mm posts and anchors. Washers shall be 45mm round and 4mm thick.
 - .6 Spikes for anchors shall be 125 mm galvanized spikes.
 - .7 Bolts, nuts, washers and other fittings shall be hot-dip galvanized in accordance with the specification of ASTM A153.
- .5 Signal Reflectors:
 - .1 Silver signal reflectors and yellow signal reflectors shall be of size 75mm x 100mm and shall be supplied by the Contractor.
- .6 Nails for Reflectors:
 - .1 Nails for securing signal reflectors, shall be supplied by the Contractor and shall consist of 30mm galvanized flat head nails.

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 guide rail 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.
- .2 Prior to commencing work, the Contractor shall locate in the field all proposed areas for installing new guide rail including special or curved installations. These locations shall be reviewed by the Departmental Representative, to confirm locations and extents. The Contractor shall contact the Departmental Representative 24 hours prior to any work being done.

3.2 ERECTION

- .1 Set posts by instrument for alignment, and locations as indicated and as directed by Departmental Representative.
- .2 The Contractor shall erect steel guiderail in accordance with the following NLDTW Standard Drawings:
 - .1 1279-1 – Typical Guiderail Installation Types
 - .2 1280-1 – Guiderail Standard Installation
 - .3 1281-1 – Sign Reflectors on Guiderail Posts
 - .4 1282-1 – Guiderail with Additional Posts
- .3 The W-beam railing shall be blocked out at posts in accordance with NLDTW Drawing Section 1279 "Typical Guiderail Installation Types" – Type "A".
- .4 To maintain consistency throughout a project, only one size post and offset block shall be used on any one section of a Contract. 200mm x 200mm offset blocks shall only be used with 200mm x 200mm posts.
- .5 Unsuitable material at the bottom of the holes excavated for guiderail shall be replaced with granular material, as directed by the Departmental Representative. The Contractor shall thoroughly compact the bottom of the hole. The guiderail posts shall rest directly and solidly on the bottom of the hole at the time of installation.
- .6 Excavated material which is unsuitable for use as a backfill shall be substituted with granular material, as directed by the Departmental Representative. Backfill shall be thoroughly compacted, in layers not exceeding 150 mm, for the full depth of the excavation. For augured post installation, hand compaction of backfill in layers not exceeding 150 mm is acceptable.
- .7 Care shall be taken during the transport, treatment and handling of posts and offset blocks to prevent damage. Any damage occurring to the posts and offset blocks prior to delivery and during delivery and installation shall be repaired to the satisfaction of the Departmental Representative and shall be considered as incidental to construction for the purpose of payment.
- .8 No alterations to treated posts and offset blocks shall be permitted without the approval of the Departmental Representative. Offset blocks shall not be manufactured from posts. Any exposed cuts shall be treated with two coats of 2% copper naphthenate wood preservative. Field applied wood preservative which comes in contact with any galvanized components shall be removed immediately.
- .9 Guiderail and guide posts shall be installed plumb, and set according to alignment and grade, regardless of the material encountered, as shown on the Drawings, or as directed by the Departmental Representative. The rail elements shall be erected to produce a smooth continuous rail paralleling the line and grade of the highway surface as directed by the Departmental Representative. All rail elements shall be lapped in the direction of traffic.
- .10 Standard W-beam rail sections shall not be modified to suit post locations; posts shall be located to match W-beam pre-punched bolt hole locations. If Contractor wishes to use two crews, on a given section, the crews shall work from the middle of the job outwards

to avoid modifications of standard W-beam rail sections due to varying post spacings. Only at the approval of the Departmental Representative, can holes be drilled or cuts be made to W-beam rail sections. Holes and cut ends shall be treated with a zinc-rich paint that has been approved by the Departmental Representative. Bolts shall be tightened to a torque of 100 Nm.

- .11 A buried end section shall be placed at each end of a run of guiderail unless directed otherwise by the Departmental Representative.
- .12 The end post of a buried end section shall have an anchor secured to the bottom of the post.
- .13 Where a 150mm x 150mm x 450 mm timber anchor is used, it shall be secured to the post by means of a galvanized nut and 16mm diameter bolt 350mm long together with two 45mm round 4mm thick galvanized washers.
- .14 Where a double 38mm x 140mm x 450mm lumber anchor is used, it shall be secured to the post by means of four 125mm galvanized spikes.
- .15 Field boring and cutting to length of anchors will be permitted, provided that the hole is treated with two coats of wood preservative before driving the bolts and provided that the cut end is treated with two coats of wood preservative before burying.
- .16 When the attachment of the rail elements to the posts has been completed, the tops of the posts shall be cut to a point 75mm above the top of the rail as shown by NLDTW Drawing Section 1279 "Typical Guiderail Installation Types" and NLDTW Drawing Section 1280 "Guiderail Standard Installation". The tops of the posts shall be treated with two coats of wood preservative after cutting.
- .17 Signal reflectors shall be attached to posts at terminal sections, posts at the buried end sections and to every fourth post in a length of guide rail. Silver reflectors shall be placed facing oncoming traffic and yellow reflectors shall be placed on the opposite side of the post except for divided highway. On divided highways, silver reflectors shall be placed facing oncoming traffic on the outside shoulder and yellow reflectors shall be placed facing on-coming traffic on the median shoulder.
 - .1 The Contractor shall drill nail holes in the reflectors, bend the reflectors to the required shape and secure the reflectors with 30 mm galvanized flat head nails as shown as shown on NLDTW Drawing Section 1281 "Signal Reflectors on Guiderail Post".
- .18 All damage to pavement, shoulders, ditches, slopes, lawns and any other surfaces and areas within or outside of the project limits, arising from the Contractor's work, shall be repaired to the satisfaction of the Departmental Representative, within five working days, at the expense of the Contractor.
- .19 Surplus excavated material and debris shall be removed from the site by the Contractor, at his expense.

3.3 TOUCH UP

- .1 The Contractor shall take all necessary precautions to eliminate damage to galvanizing.
- .2 Galvanized steel-touch up:

- .1 Cut ends, field drilled holes (permitted on bridge approach/departure elements only) and other areas where the galvanizing has minor damage shall be repaired with a minimum of two coats of zinc-rich paint according to ASTM A780, at no additional cost to the Contract. The coating thickness for the repair shall at least comply with the requirements of AASHTO M180 respecting hot dip galvanizing. Major abrasions shall be repaired by re-galvanizing. The method to be used for repair of any damage shall be approved by the Departmental Representative before such work is commenced. The Contractor, at his cost, shall carry out the repair or replace components to the satisfaction of the Departmental Representative.

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.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 ENVIRONMENTAL REQUIREMENTS

- .1 Operation of construction equipment in water is prohibited.
- .2 Do not operate construction equipment in or adjacent to watercourses or wetlands.
- .3 Do not alter or draw any water from a watercourse or wetland without first obtaining necessary permits or approvals.
- .4 Do not use watercourse beds or banks or wetlands for borrow material.
- .5 Do not dump excavated fill, waste material or debris in watercourses or wetlands.
- .6 Design and construct temporary crossings to minimize erosion to watercourse or wetland. All temporary crossings must be pre-approved by Departmental Representative prior to construction.
- .7 Do not skid logs or construction materials across watercourses or wetland.
- .8 Avoid spawning beds when constructing temporary crossings of watercourses without obtaining written approval of the Departmental Representative.
- .9 Underwater blasting within 100 m of indicated spawning beds is not permitted.
- .10 Provide a buffer zone in combination with appropriate erosion and sedimentation control when working adjacent to watercourses and wetlands. Consult with regulatory agencies.

1.2 MEASUREMENT FOR PAYMENT

- .1 The work for this Section will not be measured for payment, but will be incidental to the work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 EXISTING CONDITIONS

- .1 Maintain existing flow pattern in natural watercourse and wetland systems.
- .2 In natural systems maintain existing riffle pool and step pool patterns.
- .3 In wetland systems, maintain existing hydrological conditions.

3.2 SITE CLEARING AND PLANT PROTECTION

- .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, according to requirements of authorities having jurisdiction and sediment and erosion control plan, specific to site, whichever is more stringent.
 - .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 Minimize disturbance to vegetated buffer zones and protect trees and plants on site and adjacent properties where indicated.
- .3 Wrap trees and shrubs adjacent to construction work, storage areas and trucking lanes in burlap.
- .4 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .5 Leave cuttings from trees and other vegetation on site as brush piles to allow for natural degradation.
 - .1 Secure large piles with degradable materials to prevent interference with watercourse.
- .6 Remove only trees that may offer future blockage problems as instructed by Departmental Representative.
- .7 Leave roots mass and stumps in place.
- .8 Maintain temporary erosion and pollution control features installed under this contract.

3.3 DRAINAGE AND PUMPING

- .1 Pumping water containing suspended materials into watercourse or wetland is prohibited. Discharge location shall be minimum 30 metres from any watercourse or wetland unless pumped through a filter bag connected to the pump discharge.
- .2 Establish rock chute spillways to accommodate safe surface water entry to watercourse or wetland as directed by Departmental Representative.
- .3 Install drop pipe inlet system as instructed by Departmental Representative.
- .4 All fish occupying a reach of watercourse to be dewatered or abandoned must be rescued and relocated out of harm's way prior to any permanent or temporary dewatering operation in accordance with regulatory guidelines.

3.4 SITE RESTORATION

- .1 Establish vegetated buffer zones with suitable vegetation to minimum 3 m along edge of watercourse banks as determined by Departmental Representative.
- .2 Plant vegetation natural to area, suitable for application without requirement for fertilizers, pesticides and other chemicals.
- .3 Control stream bank erosion in lower section of watercourse with irregular shaped rip rap underlain with non-toxic recycled content of size determined by Departmental Representative.
- .4 Control stream bank erosion in upper section of watercourse by planting suitable vegetation as directed by Departmental Representative.
 - .1 Ensure planting occurs within 15 days after work on watercourse is complete.

END OF SECTION

APPENDIX

A

SOILSIGHT
CONDITION
ASSESSMENTS
(INVERSA)

SoilSight™ Condition Assessment

Parks Canada NL - 2021

Cobblers Brook Culvert - North

Route 1 in Census Division No. 7

General Summary

The asset Cobblers Brook Culvert - North located on Route 1 in Census Division No. 7, consists of a spiral wound circular corrugated metal pipe (CMP) with a concrete paved invert (CPI). The asset is located at latitude 48° 25' 9.298" N, longitude 54° 8' 3.71" W. The dimensions of the asset were found to be approximately 3.30 m vertically, 3.60 m horizontally and 49.30 m in length. The asset has approximately 6.00 m of cover from the obvert to the road surface and flows generally west to east.

This pipe was part of a double pipe structure where two (2) parallel culverts were found at the same location. To provide unique identifiers for each pipe, they were labelled from north to south. Considering each pipe's proximity and interdependence, these asset's should be considered as a whole.

Inversa Systems performed an in-depth condition assessment of this asset to aid in life cycle optimization.

Details of this work are contained within this report; a summary is as follows:

- 3 visual indicators were located
- InSight™ Lite anomalies were identified
- No inSight™ BCT scans were taken
- Outcome: Maintenance Recommended
- Estimated Cost of Maintenance: \$18,000.00 excluding taxes
- Recommended Completion: 8 to 14 months
- Estimated Maintenance Duration: 1 to 2 days

Asset ID	Cobblers Brook Culvert - North
Location	Census Division No. 7
GPS	48° 25' 9.298" N, 54° 8' 3.71" W
Inspection Date	September 29, 2021
Written By	Colin Hansen, Field Tech.
Reviewed By	Dave Beckingham, Technologist.
Approved By	Jocelin Bourgeois, B.Sc.Eng., MBA



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Technical Explanation of Pipe Map Protocol

The entire culvert inspection is captured in the soilSight™ Pipe Map found in the following pages. It shows the asset in its entirety and displays the following collected data:

- Visual indicators
- Acoustic anomalies
- InSight™ BCT locations / results
- InSight™ Lite screening
- Water level
- Pipe dimensions

Sections within each asset that contain BCT image locations, inSight™ Lite screening, acoustic anomalies or visual indicators are displayed on a separate Segmented soilSight™ Pipe Map, which provides a more detailed view. The purpose of this level of detail is to define the exact location of all acoustic anomalies, visual indicators, inSight™ Lite locations, and BCT locations for future reference, deterioration trending, rehabilitation efforts and will allow detailed measurements to be used for maintenance, repairs or rehabilitation planning. The number of segments is at the discretion of the report writer and is based on the number of deficiencies discovered. If no repairs are required, measurements should be used to trend deterioration from one inspection cycle to another.

The X-coordinates are measured relative to the pipe inlet. The Y-coordinates are defined by a clock position with the invert being 6 o'clock, the obvert being 12 o'clock, the left springline being 9 o'clock and the right springline being 3 o'clock with the Inversa field inspector oriented facing downstream from the inlet to outlet (with the inlet at their back).

Acoustic Assessment

The purpose of the acoustic assessment or “knock test” is to determine possible locations (not severity) of suspected voids in the pipe's supporting soil and to aid in targeting and prioritization of anomaly imaging with BCT. A detailed knock test is performed at every second corrugation (approximately every 15-20 cm (6-8 in)) on both sides of the pipe, at five relative elevations: waterline, pipe springline, forty-five degrees above and below springline and obvert. Based on the acoustic and/or inSight™ Lite screening, the soilSight™ Pipe Map is generated to guide diagnostic imaging. Note: the terminal (unburied) ends of the pipe are considered transition zones and are not mapped unless voids are visible or extend beyond the transition zone.

Visual Inspection

The purpose of the visual inspection is to identify and locate deficiencies within the entire culvert structure. The visual inspection assesses ten (10) components of the structure, beginning from the road surface down through to the pipe barrel. Rankings are assigned a value between 1 and 5 for each component, based on pre-determined criteria. Inspector field notes are also recorded for each of the ten (10) components. Specific visual indicators are flaws found within the pipe barrel that have a location associated with them.

These visual anomalies are reflected in the soilSight™ Pipe Map in relation to the entire structure. Examples are separated joints, bolt-hole tears, through-wall corrosion, etc. ASTM C1870/C1840M shall be used to evaluate the infiltration of water inside the culvert. The levels of infiltration are as follows:

- Level 1 Infiltration - Moisture visible on the surface of the culvert
- Level 2 Infiltration - Slow entry of water identified by visible drips
- Level 3 Infiltration - Continuous stream of water running inside culvert

InSight™ BCT Images

BCT analysis is undertaken after the visual inspection, the acoustic and the inSight™ Lite screening only if warranted. Once an acoustic anomaly is identified, a more thorough “knock test” is performed within the anomaly to find the precise location for BCT deployment. Typically, BCT scans are captured within the acoustic anomalies and/or inSight™ Lite regions. Visual indicators can also dictate scan locations if they demonstrate evidence of soil loss in a specific area. Once all scans are captured for an asset, they are uploaded to the InSight™ portal service where the images are processed, and voids are quantified.

InSight™ Lite Screening

The purpose of the inSight™ Lite screening is to identify areas of potential low soil density / void behind the culvert wall. Once anomalous areas are identified through the inSight™ Lite screening, the asset owner can then validate and quantify these regions through inSight™ BCT imaging.

A detailed soil density measurement is collected every 0.5 m to 1.0 m (20 to 40 in) increment inside the pipe wall, taken every available clock position. Once all inSight™ Lite measurements are captured, they are uploaded to the soilSight™ portal where the measurements are processed, and potential anomalous locations are identified within the pipe map. The regions are categorized based on their probability to contain voids, from low probability being yellow to high probability being brown.

Regardless of whether inSight™ BCT imaging was completed, inSight™ Lite data sets should be used on subsequent inspections to trend soil density changes and aid in prioritization of which assets warrant further assessment, ultimately leading towards a more comprehensive asset management program.

Visual Appraisal Results

Following the inSight™ BCT Validation Results section (if applicable) is the Visual Appraisal Results, where ten components of the structure are ranked between 1 and 5. Each rank, for each component, has a precise definition associated with it, based on best practices and industry standards. The criteria are defined in Inversa’s soilSight™ Standard Operating Procedure (SOP), available upon request.

Each 1 to 5 ranking has an associated condition description, used for reporting purposes, as follows:

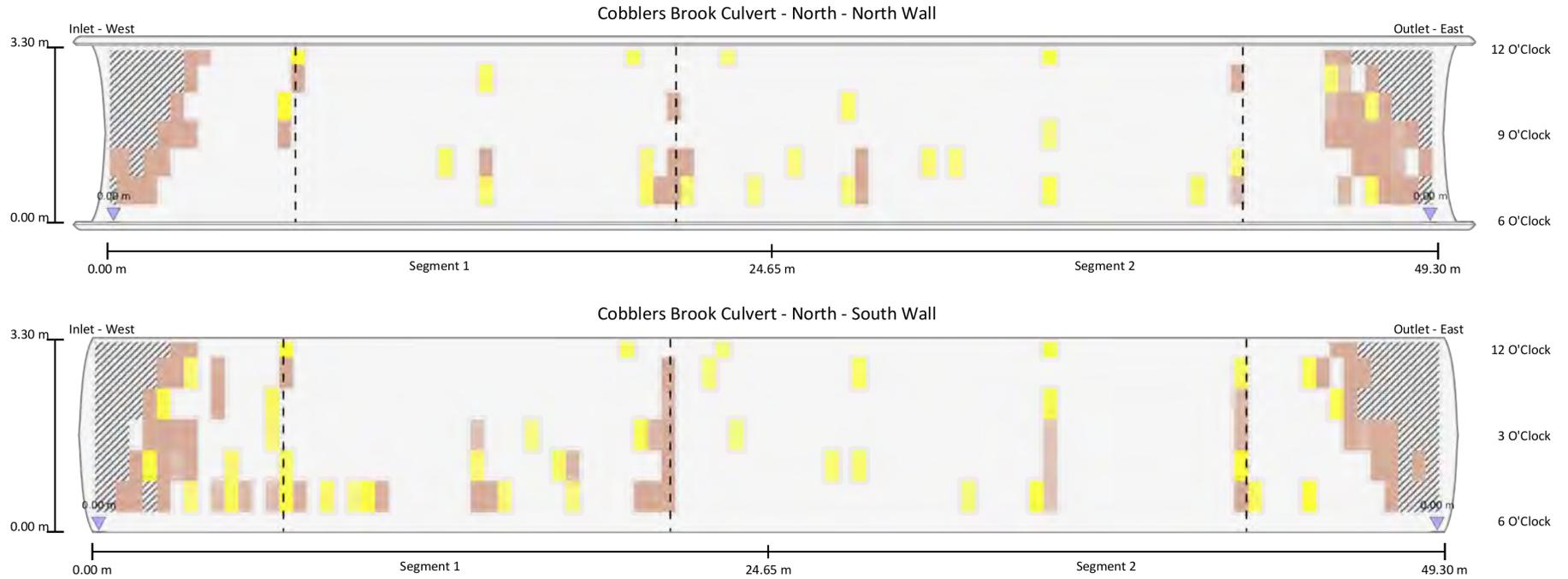
- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)
- High Probability of Failure (5)

Shape Deviation

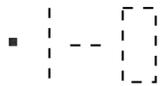
Horizontal and vertical measurements are taken in the field at even intervals along the culvert. This information is used to trend future changes of pipe geometry indicating possible instability, unequal loading, or soil movement. A corresponding percentage difference from expected horizontal and vertical dimensions are provided in the Shape Deviation table.

Conclusion and Recommendations

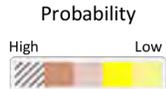
Conclusion and Recommendations are provided with any potential maintenance and/or rehabilitation recommendations including any estimated maintenance costs. The focus of the conclusion is mainly limited to components with a ranking of 3 or above unless specific concerns need to be addressed. If a detailed rehabilitation plan is warranted, a separate Asset Rehabilitation Plan is provided.



Acoustic Anomalies are designated as rectangles and are assigned an ID number. The X and Y position is recorded and displayed in the table for the corresponding pipe segment.



Visual Indicators are shown as black squares (isolated defects), dashed lines (linear defects) or rectangles with dashed lines (defects with a surface area), depending on the flaw type, and assigned a corresponding ID number. The X and Y position is recorded and displayed in the table for the corresponding pipe segment. Photos are included in the visual assessment section.



InSight™ Lite Anomalies are regions detected by the InSight™ Lite scanner which may contain voids or other low density material. The regions are categorized in terms of their probability to contain actual soil voids, from low probability being yellow to high probability being brown. The unburied ends of the culvert are represented as rectangles with black hash marks.

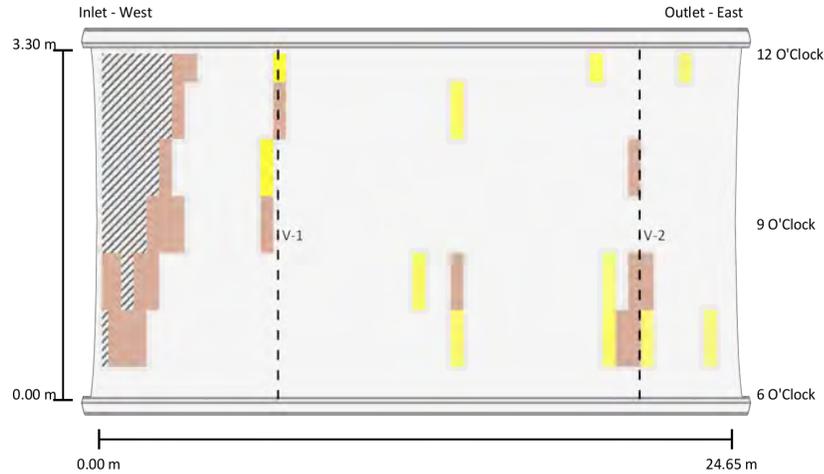


InSight™ BCT Images are assigned an ID number and are represented as red diamonds. Once a scan is captured, it is verified as void or solid backfill. The X and Y position is recorded and displayed in the table for the corresponding pipe segment.



Waterline Marks indicate the level of water in the pipe at the time of inspection.

Segment 1 - Cobblers Brook Culvert - North - North Wall



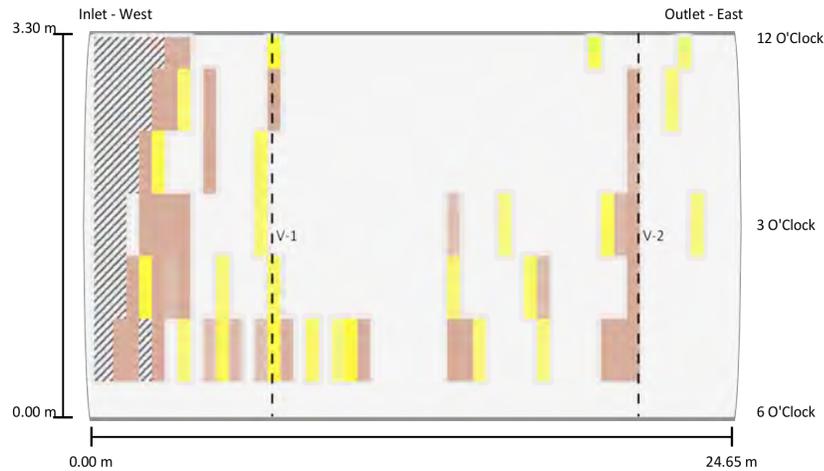
Visual Indicators

	X1	X2	Clock 1	Clock 2	Comments
V-1	7.00 m	7.00 m	-	-	Separated and offset joint by approximately 120 mm with visible backfill material, as well as surface corrosion at joint connection.
V-2	21.10 m	21.10 m	-	-	Separated and offset joint by approximately 110 mm with visible filter fabric, and backfill material present.

Acoustic Anomalies

	X1	X2	Clock 1	Clock 2
No acoustic anomalies found.				

Segment 1 - Cobblers Brook Culvert - North - South Wall

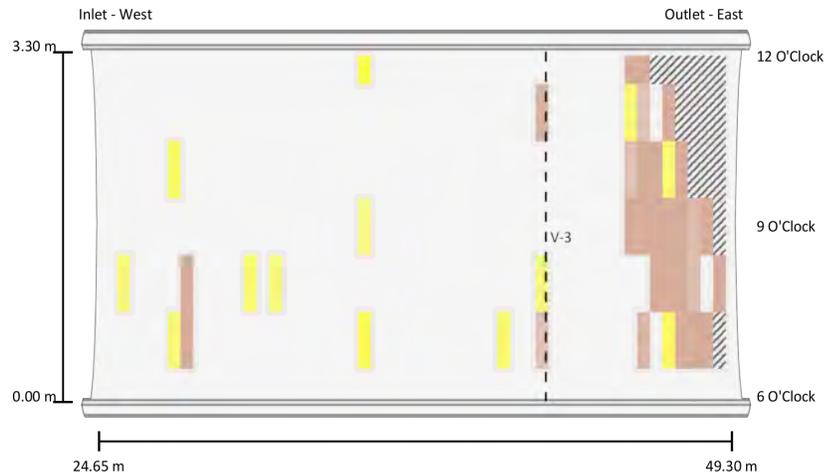


Insight™ BCT Images

X	Clock	Scan ID	Verdict
No BCT images included.			

- □ Visual Indicators
- ◆ ◆ InSight™ BCT Images
- Acoustic Anomalies
- ▨ InSight™ Lite Anomalies

Segment 2 - Cobblers Brook Culvert - North - North Wall



Visual Indicators

	X1	X2	Clock 1	Clock 2	Comments
V-3	42.10 m	42.10 m	-	-	Separated joint by approximately 120 mm with a visible coupler.

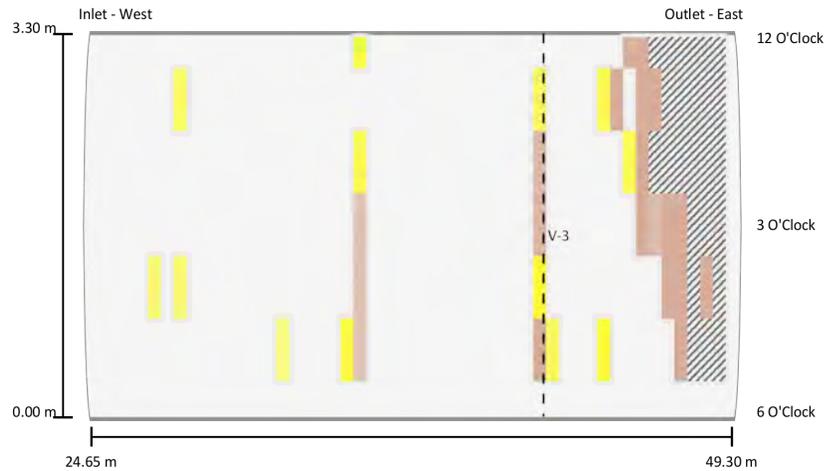
Acoustic Anomalies

	X1	X2	Clock 1	Clock 2
No acoustic anomalies found.				

InSight™ BCT Images

X	Clock	Scan ID	Verdict
No BCT images included.			

Segment 2 - Cobblers Brook Culvert - North - South Wall



- [] Visual Indicators
- ◆ ◆ InSight™ BCT Images
- Acoustic Anomalies
- ▨ InSight™ Lite Anomalies

The visual appraisal assesses ten Components.

Each "Component" is ranked 1 through 5 with 1 being "excellent" and 5 being "high probability of failure". "Ranks" are based on measurable field observations for each "Component" evaluated and based on industry standards where available. "Comments" are provided based on visual field notes as applicable.

Pavement

Rank 1

Pavement in excellent condition.



Photo 1 - Route 1 facing north.



Photo 2 - Route 1 facing south.

Guardrail

Rank 1

Guardrail in near new condition. No corrosion or missing components. No damage present. Location as designed. Structure well aligned both horizontally and vertically.

Minor damage identified on one (1) of the outlet guardrail posts.

Inlet guardrail.: Present.

Outlet guardrail.: Present.

- Broken, rotten, or damaged post(s) present.

Number of damaged posts.: 1



Photo 3 - Inlet guardrail.



Photo 4 - Minor damage on post along outlet guardrail.



Photo 5 - Inlet guardrail.



Photo 6 - Outlet guardrail.

Embankment

Rank 1

Embankment stable, no visible ruts or erosion channels. No large vegetation present.

Inlet Embankment

- Rip-Rap stabilizing embankment present.

Outlet Embankment

- Rip-Rap stabilizing embankment present.



Photo 7 - Inlet embankment, facing south.



Photo 8 - Outlet embankment, facing south.



Photo 9 - Inlet embankment.



Photo 10 - Outlet embankment.

Headwall

Rank N/A

Inlet Headwall: No headwall present.

Outlet Headwall: No headwall present.



Photo 11 - Inlet overview.



Photo 12 - Outlet overview.

Waterway Blockage

Rank 1

No waterway blockages found.



Photo 13 - Upstream channel view.

Scour

Rank 1

No scour evident.

Corrosion and Coatings

Rank 2

- Corrosion present: **Severity:** Surface corrosion present.

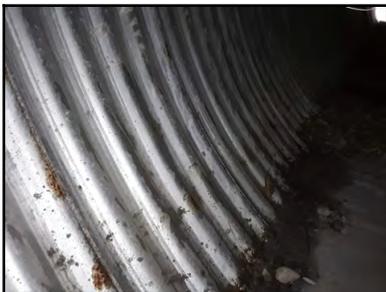


Photo 14 - Typical surface corrosion present throughout the pipe.

Cracks, Seams, and Joints

Rank 3

- Joint offset(s) present: **Severity:** Moderate (< 200 mm (8 in) Width).
 - Coupling device visible through joint offset(s).
 - Substrate visible through joint offset(s).
- Joint separation(s) present: **Severity:** Moderate (< 200 mm (8 in) Width).
 - Coupling device visible through joint separation(s).
 - Substrate visible through joint separation(s).

Shape, Dents, and Localized Damage

Rank 2

Maximum shape deviation of approximately -5.6%. No dents or localized damage found.

Pipe Alignment

Rank 2

- Pipe misalignment present: **Condition:** Horizontal misalignment.



Photo 15 - Upstream pipe alignment and shape.



Photo 16 - Downstream pipe alignment and shape.

Shape deviation measurements are used to examine the structure's current deformation. Deformation may be caused by construction or deterioration. This information is intended to be used to trend future changes of pipe geometry indicating possible instability, unequal loading, or soil movement.

A horizontal and vertical measurement of the pipe's dimension is taken at even intervals along the pipe. A corresponding percentage difference from the expected horizontal and vertical design dimensions is also calculated.

The expected design measurements for Cobblers Brook Culvert - North are 3300 mm vertically and 3600 mm horizontally.

Distance from Inlet	Horizontal Diameter	Horizontal Deviation	Vertical Diameter	Vertical Deviation
0.00 m	3520 mm	-2.2%	3470 mm	5.2%
10.00 m	3530 mm	-1.9%	3220 mm	-2.4%
20.00 m	3400 mm	-5.6%	3270 mm	-0.9%
30.00 m	3490 mm	-3.1%	3150 mm	-4.5%
40.00 m	3600 mm	0.0%	3240 mm	-1.8%
49.00 m	3600 mm	0.0%	3330 mm	0.9%

Note: Vertical deviation measurements may be missing due to sediment or debris build up.

Pertinent photos are included below to show site conditions and features of interest.



Photo 1 - Route 1 facing north.



Photo 2 - Route 1 facing south.



Photo 3 - Inlet guardrail.



Photo 4 - Minor damage on post along outlet guardrail.



Photo 5 - Inlet guardrail.



Photo 6 - Outlet guardrail.



Photo 7 - Inlet embankment, facing south.



Photo 8 - Outlet embankment, facing south.



Photo 9 - Inlet embankment.



Photo 10 - Outlet embankment.



Photo 11 - Inlet overview.



Photo 12 - Outlet overview.



Photo 13 - Upstream channel view.



Photo 14 - Typical surface corrosion present throughout the pipe.



Photo 15 - Upstream pipe alignment and shape.



Photo 16 - Downstream pipe alignment and shape.



Photo 17 - V-1: Separated and offset joint by approximately 120 mm with visible backfill material, as well as surface corrosion at joint connection.



Photo 18 - V-1: Separated and offset joint by approximately 120 mm with visible backfill material, as well as surface corrosion at joint connection.



Photo 19 - V-1: Separated and offset joint by approximately 120 mm with visible backfill material, as well as surface corrosion at joint connection.



Photo 20 - V-2: Separated and offset joint by approximately 110 mm with visible filter fabric, and backfill material present.



Photo 21 - V-2: Separated and offset joint by approximately 110 mm with visible filter fabric, and backfill material present.

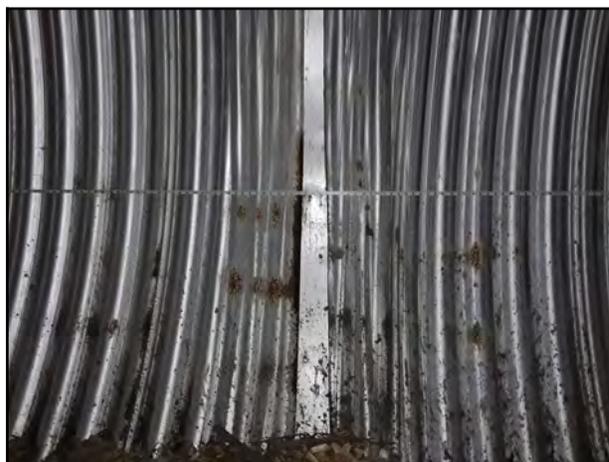


Photo 22 - V-2: Separated and offset joint by approximately 110 mm with visible filter fabric, and backfill material present.



Photo 23 - V-2: Separated and offset joint by approximately 110 mm with visible filter fabric, and backfill material present.

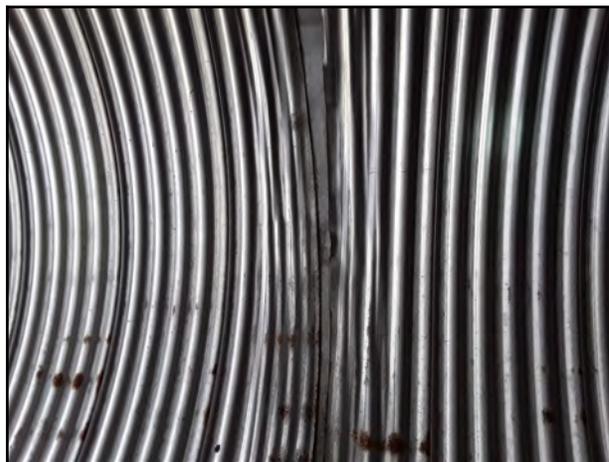


Photo 24 - V-3: Separated joint by approximately 120 mm with a visible coupler.



Photo 25 - V-3: Separated joint by approximately 120 mm with a visible coupler.



Photo 26 - Ditch drainage CMP pipe located upstream of the asset.



Photo 27 - Pipe was previously lined with a concrete paved invert.



Photo 28 - Trail camera installed within the asset, at 21.00 m.

The asset Cobblers Brook Culvert - North located on Route 1 in Census Division No. 7, consists of a spiral wound circular corrugated metal pipe (CMP) culvert that was previously rehabilitated with a concrete paved invert (CPI), and appears to be used as an animal crossing with approximate dimensions of 3.30 m vertically, 3.60 m horizontally and 49.30 m in length. Visual inspections and inSight™ Lite assessment were performed at this site which found three (3) visual indicators, and some inSight™ Lite anomalous regions inside the culvert. No BCT scans were completed on this asset.

The culvert was found to be in good condition and performing as designed, however, a few deficiencies were noted. The visual inspection revealed three (3) visual indicators throughout the pipe. V-1 and V-2 documented separated and offset joints measuring approximately 120 mm and 110 mm, with visible backfill material. V-1 also displayed surface corrosion surrounding the joint connection. V-3 identified a separated joint with a visible coupler measuring approximately 120 mm.

The deviation from expected design shape varied through the pipe with a maximum horizontal deviation of -5.6%, 20.00 m from the inlet and a maximum vertical deviation of 5.2%, 0.00 m from the inlet.

The inSight™ Lite assessment identified some areas of potential soil loss within the culvert barrel. Given the limited size and quantity, as well as the location of the identified areas of potential soil loss, no inSight™ BCT inspection was performed at this asset, and no immediate remediation plan is required for the identified areas.

Based on the findings, the deficient joints with visible backfill material identified within the asset, V-1, and V-2, if not repaired in a timely manner, could lead to soil loss and potential soil movement above the asset.

It is therefore recommended that the deficient joints, V-1, and V-2, be repaired with an appropriate repair method (e.g. hydraulic mortar cement, flexible seal or internal bands coupled with gaskets) within the next 8 to 14 months. The estimated cost of maintenance is \$18,000.00 excluding taxes. The maintenance cost estimation is assumed to be part of a larger contract work and not as a stand-alone asset activity. Maintenance duration is estimated at 1 to 2 days.

Given their proximity, and seeing as they form part of the same hydraulic system, consideration should be given to completing the prescribed maintenance work in conjunction with the prescribed work for asset Cobblers Brook Culvert - South.

In the interim, and following the maintenance work, it is recommended that the asset continues to be monitored at its current inspection intervals.

SoilSight™ Condition Assessment

Parks Canada NL - 2021

Cobblers Brook Culvert - South

Route 1 in Census Division No. 7

General Summary

The asset Cobblers Brook Culvert - South located on Route 1 in Census Division No. 7, consists of a multi-plate circular corrugated metal pipe (CMP) culvert. The asset is located at latitude 48° 25' 8.859" N, longitude 54° 8' 3.394" W. The dimensions of the asset were found to be approximately 4.20 m in diameter and 58.00 m in length. The asset has approximately 7.32 m of cover from the obvert to the road surface and flows generally west to east.

This pipe was part of a double pipe structure where two (2) parallel culverts were found at the same location. To provide unique identifiers for each pipe, they were labelled from north to south. Considering each pipe's proximity and interdependence, these asset's should be considered as a whole.

Inversa Systems performed an in depth condition assessment of this asset to aid in life cycle optimization.

Details of this work are contained within this report; a summary is as follows:

- 11 visual indicators were located
- InSight™ Lite anomalies were identified
- 6 voids were observed, 7 inSight™ BCT images were completed
- Outcome: Maintenance Recommended
- Estimated Cost of Maintenance: \$60,000.00 excluding taxes
- Recommended Completion: 6 to 12 months
- Estimated Maintenance Duration: 7 to 10 days

Asset ID	Cobblers Brook Culvert - South
Location	Census Division No. 7
GPS	48° 25' 8.859" N, 54° 8' 3.394" W
Inspection Date	September 29, 2021
Written By	Colin Hansen, Field Tech.
Reviewed By	Dave Beckingham, Technologist.
Approved By	Jocelin Bourgeois, B.Sc.Eng., MBA



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Technical Explanation of Pipe Map Protocol

The entire culvert inspection is captured in the soilSight™ Pipe Map found in the following pages. It shows the asset in its entirety and displays the following collected data:

- Visual indicators
- Acoustic anomalies
- InSight™ BCT locations / results
- InSight™ Lite screening
- Water level
- Pipe dimensions

Sections within each asset that contain BCT image locations, inSight™ Lite screening, acoustic anomalies or visual indicators are displayed on a separate Segmented soilSight™ Pipe Map, which provides a more detailed view. The purpose of this level of detail is to define the exact location of all acoustic anomalies, visual indicators, inSight™ Lite locations, and BCT locations for future reference, deterioration trending, rehabilitation efforts and will allow detailed measurements to be used for maintenance, repairs or rehabilitation planning. The number of segments is at the discretion of the report writer and is based on the number of deficiencies discovered. If no repairs are required, measurements should be used to trend deterioration from one inspection cycle to another.

The X-coordinates are measured relative to the pipe inlet. The Y-coordinates are defined by a clock position with the invert being 6 o'clock, the obvert being 12 o'clock, the left springline being 9 o'clock and the right springline being 3 o'clock with the Inversa field inspector oriented facing downstream from the inlet to outlet (with the inlet at their back).

Acoustic Assessment

The purpose of the acoustic assessment or “knock test” is to determine possible locations (not severity) of suspected voids in the pipe's supporting soil and to aid in targeting and prioritization of anomaly imaging with BCT. A detailed knock test is performed at every second corrugation (approximately every 15-20 cm (6-8 in)) on both sides of the pipe, at five relative elevations: waterline, pipe springline, forty-five degrees above and below springline and obvert. Based on the acoustic and/or inSight™ Lite screening, the soilSight™ Pipe Map is generated to guide diagnostic imaging. Note: the terminal (unburied) ends of the pipe are considered transition zones and are not mapped unless voids are visible or extend beyond the transition zone.

Visual Inspection

The purpose of the visual inspection is to identify and locate deficiencies within the entire culvert structure. The visual inspection assesses ten (10) components of the structure, beginning from the road surface down through to the pipe barrel. Rankings are assigned a value between 1 and 5 for each component, based on pre-determined criteria. Inspector field notes are also recorded for each of the ten (10) components. Specific visual indicators are flaws found within the pipe barrel that have a location associated with them.

These visual anomalies are reflected in the soilSight™ Pipe Map in relation to the entire structure. Examples are separated joints, bolt-hole tears, through-wall corrosion, etc. ASTM C1870/C1840M shall be used to evaluate the infiltration of water inside the culvert. The levels of infiltration are as follows:

- Level 1 Infiltration - Moisture visible on the surface of the culvert
- Level 2 Infiltration - Slow entry of water identified by visible drips
- Level 3 Infiltration - Continuous stream of water running inside culvert

InSight™ BCT Images

BCT analysis is undertaken after the visual inspection, the acoustic and the inSight™ Lite screening only if warranted. Once an acoustic anomaly is identified, a more thorough “knock test” is performed within the anomaly to find the precise location for BCT deployment. Typically, BCT scans are captured within the acoustic anomalies and/or inSight™ Lite regions. Visual indicators can also dictate scan locations if they demonstrate evidence of soil loss in a specific area. Once all scans are captured for an asset, they are uploaded to the InSight™ portal service where the images are processed, and voids are quantified.

InSight™ Lite Screening

The purpose of the inSight™ Lite screening is to identify areas of potential low soil density / void behind the culvert wall. Once anomalous areas are identified through the inSight™ Lite screening, the asset owner can then validate and quantify these regions through inSight™ BCT imaging.

A detailed soil density measurement is collected every 0.5 m to 1.0 m (20 to 40 in) increment inside the pipe wall, taken every available clock position. Once all inSight™ Lite measurements are captured, they are uploaded to the soilSight™ portal where the measurements are processed, and potential anomalous locations are identified within the pipe map. The regions are categorized based on their probability to contain voids, from low probability being yellow to high probability being brown.

Regardless of whether inSight™ BCT imaging was completed, inSight™ Lite data sets should be used on subsequent inspections to trend soil density changes and aid in prioritization of which assets warrant further assessment, ultimately leading towards a more comprehensive asset management program.

Visual Appraisal Results

Following the inSight™ BCT Validation Results section (if applicable) is the Visual Appraisal Results, where ten components of the structure are ranked between 1 and 5. Each rank, for each component, has a precise definition associated with it, based on best practices and industry standards. The criteria are defined in Inversa’s soilSight™ Standard Operating Procedure (SOP), available upon request.

Each 1 to 5 ranking has an associated condition description, used for reporting purposes, as follows:

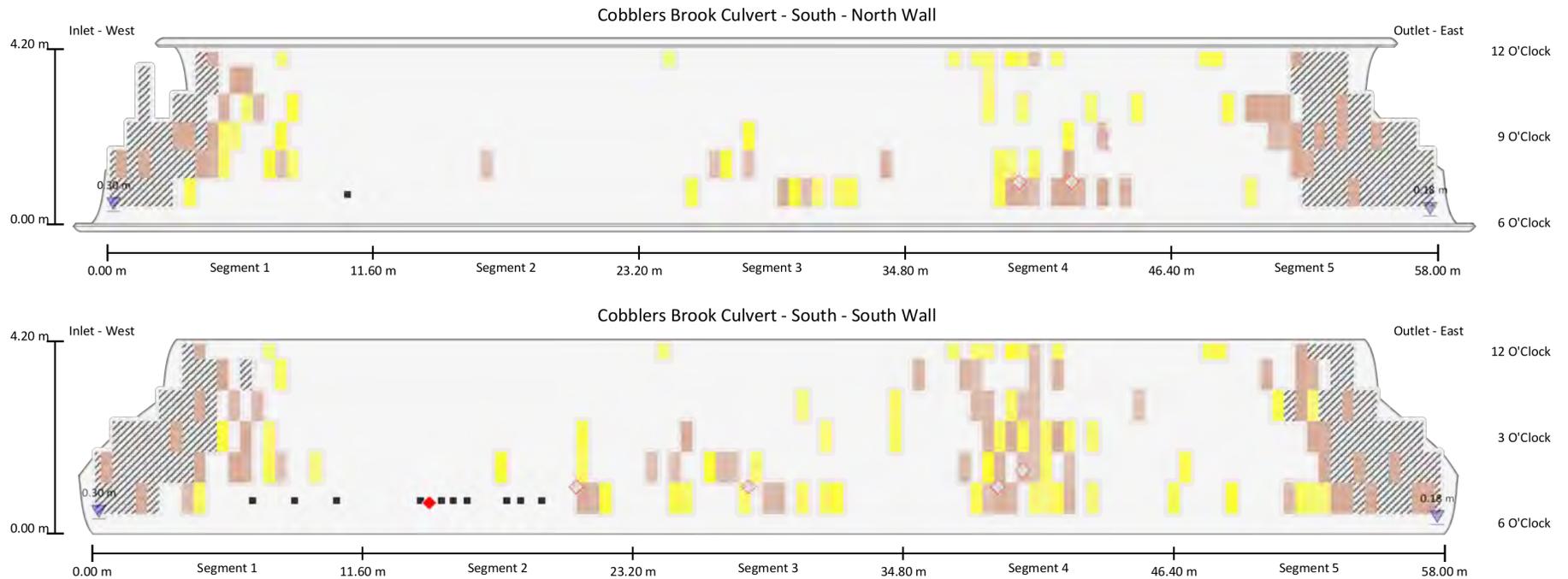
- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)
- High Probability of Failure (5)

Shape Deviation

Horizontal and vertical measurements are taken in the field at even intervals along the culvert. This information is used to trend future changes of pipe geometry indicating possible instability, unequal loading, or soil movement. A corresponding percentage difference from expected horizontal and vertical dimensions are provided in the Shape Deviation table.

Conclusion and Recommendations

Conclusion and Recommendations are provided with any potential maintenance and/or rehabilitation recommendations including any estimated maintenance costs. The focus of the conclusion is mainly limited to components with a ranking of 3 or above unless specific concerns need to be addressed. If a detailed rehabilitation plan is warranted, a separate Asset Rehabilitation Plan is provided.



 **Acoustic Anomalies** are designated as rectangles and are assigned an ID number. The X and Y position is recorded and displayed in the table for the corresponding pipe segment.

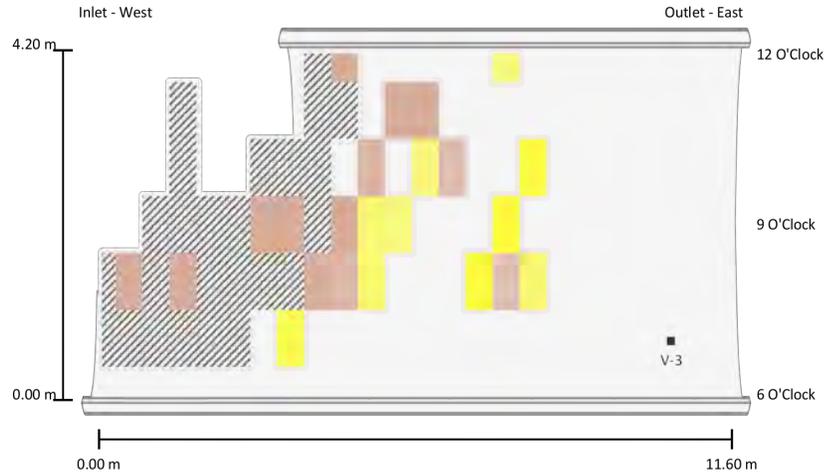
 **Visual Indicators** are shown as black squares (isolated defects), dashed lines (linear defects) or rectangles with dashed lines (defects with a surface area), depending on the flaw type, and assigned a corresponding ID number. The X and Y position is recorded and displayed in the table for the corresponding pipe segment. Photos are included in the visual assessment section.

Probability
 **InSight™ Lite Anomalies** are regions detected by the InSight™ Lite scanner which may contain voids or other low density material. The regions are categorized in terms of their probability to contain actual soil voids, from low probability being yellow to high probability being brown. The unburied ends of the culvert are represented as rectangles with black hash marks.

 **InSight™ BCT Images** are assigned an ID number and are represented as red diamonds. Once a scan is captured, it is verified as void or solid backfill. The X and Y position is recorded and displayed in the table for the corresponding pipe segment.

 **Waterline Marks** indicate the level of water in the pipe at the time of inspection.

Segment 1 - Cobblers Brook Culvert - South - North Wall



Visual Indicators

	X1	X2	Clock 1	Clock 2	Comments
V-1	6.90 m	-	05:00	-	Level 3 water infiltration at seam.
V-2	8.70 m	-	05:00	-	Level 3 water infiltration at bolt.
V-3	10.50 m	-	07:00	-	Level 3 water infiltration at bolt.
V-4	10.50 m	-	05:00	-	Level 2 water infiltration at seam.

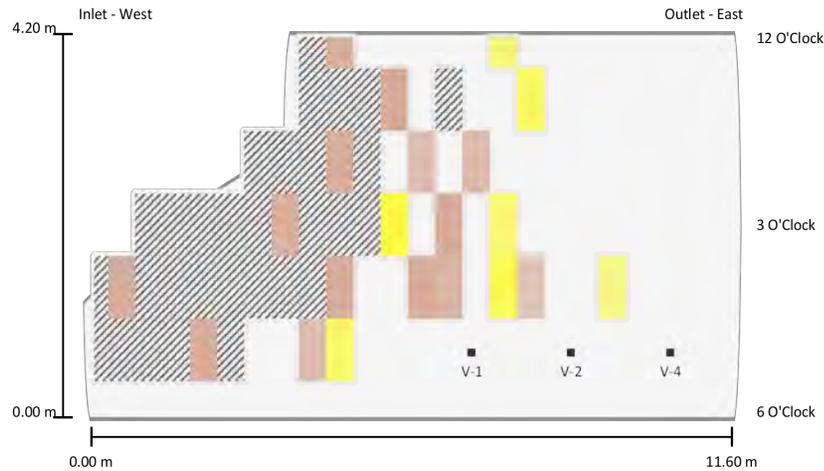
Acoustic Anomalies

X1	X2	Clock 1	Clock 2
No acoustic anomalies found.			

Insight™ BCT Images

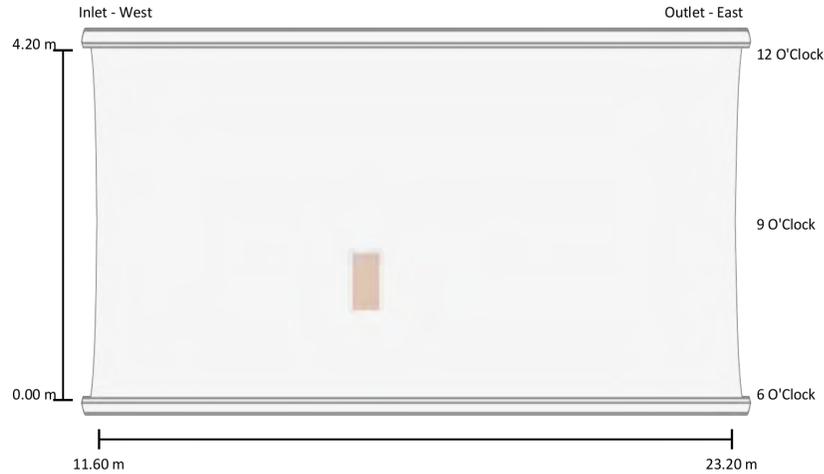
X	Clock	Scan ID	Verdict
No BCT images included.			

Segment 1 - Cobblers Brook Culvert - South - South Wall



- [dashed box] Visual Indicators
- ◆ [red diamond] InSight™ BCT Images
- [grey square] Acoustic Anomalies
- [yellow square] InSight™ Lite Anomalies

Segment 2 - Cobblers Brook Culvert - South - North Wall



Visual Indicators

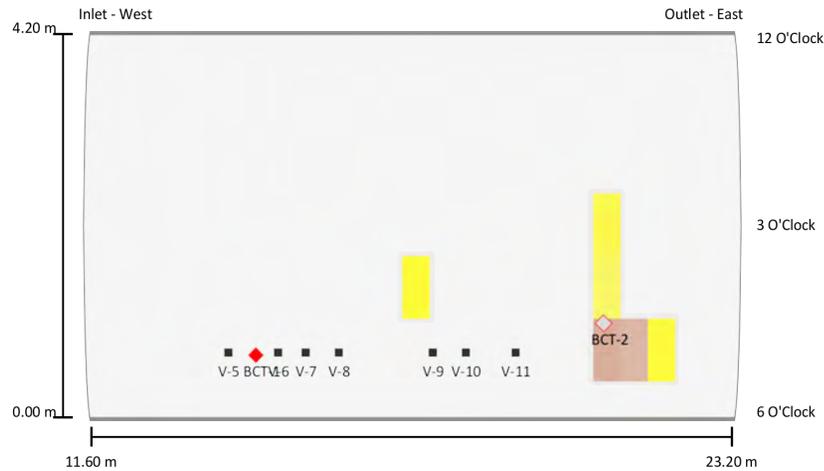
	X1	X2	Clock 1	Clock 2	Comments
V-5	14.10 m	-	05:00	-	Level 3 water infiltration at seam.
V-6	15.00 m	-	05:00	-	Level 3 water infiltration at bolt.
V-7	15.50 m	-	05:00	-	Level 3 water infiltration at bolt.
V-8	16.10 m	-	05:00	-	Level 2 water infiltration at bolt.
V-9	17.80 m	-	05:00	-	Level 3 water infiltration at bolt and seam.
V-10	18.40 m	-	05:00	-	Level 3 water infiltration at bolt.
V-11	19.30 m	-	05:00	-	Level 3 water infiltration at bolt.

Acoustic Anomalies

X1	X2	Clock 1	Clock 2
----	----	---------	---------

No acoustic anomalies found.

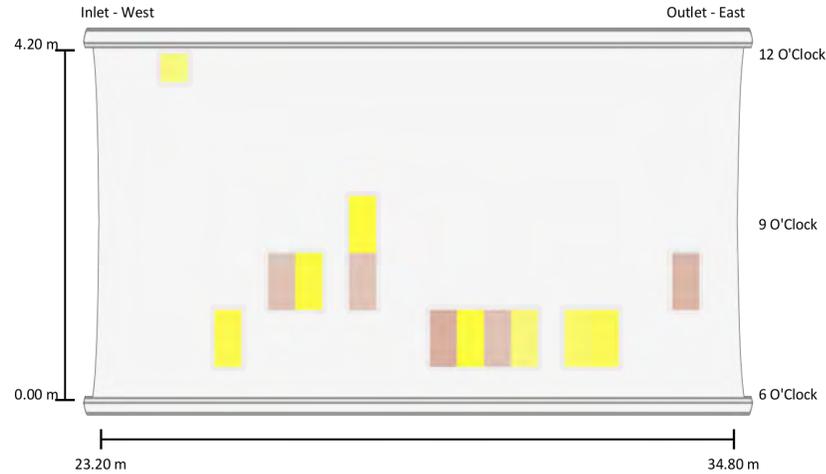
Segment 2 - Cobblers Brook Culvert - South - South Wall



InSight™ BCT Images

	X	Clock	Scan ID	Verdict
BCT-1	14.70 m	05:00	6476	No void. Control point.
BCT-2	21.00 m	04:30	6477	Multiple voids, maximum size 77 mm x 40 mm.

Segment 3 - Cobblers Brook Culvert - South - North Wall



Visual Indicators

X1	X2	Clock 1	Clock 2	Comments
No visual indicators found.				

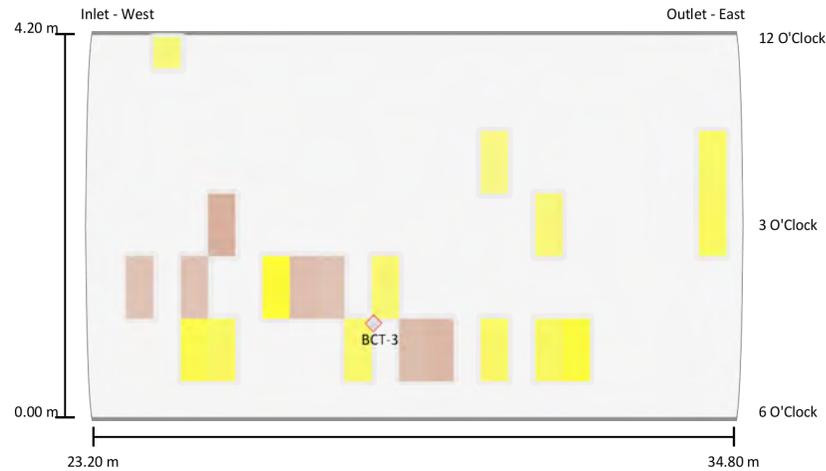
Acoustic Anomalies

X1	X2	Clock 1	Clock 2
No acoustic anomalies found.			

Insight™ BCT Images

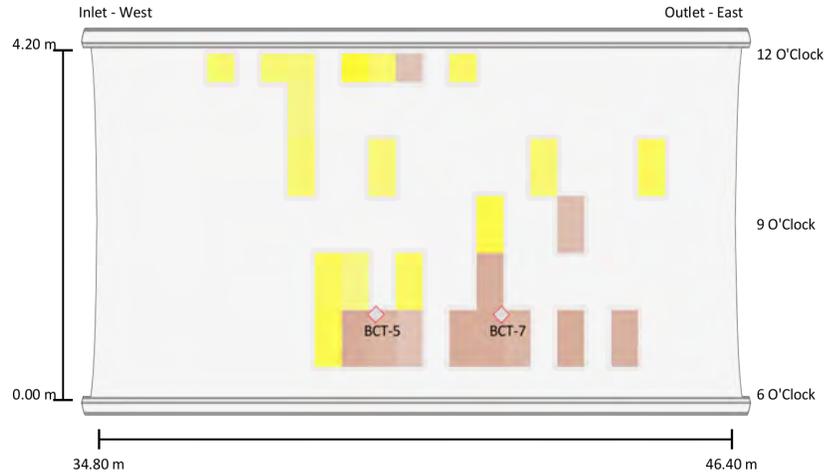
	X	Clock	Scan ID	Verdict
BCT-3	28.40 m	04:30	6478	Multiple voids, maximum size 51 mm x 52 mm.

Segment 3 - Cobblers Brook Culvert - South - South Wall



- [] Visual Indicators
- ◆ ◆ InSight™ BCT Images
- Acoustic Anomalies
- InSight™ Lite Anomalies

Segment 4 - Cobblers Brook Culvert - South - North Wall



Visual Indicators

X1	X2	Clock 1	Clock 2	Comments
No visual indicators found.				

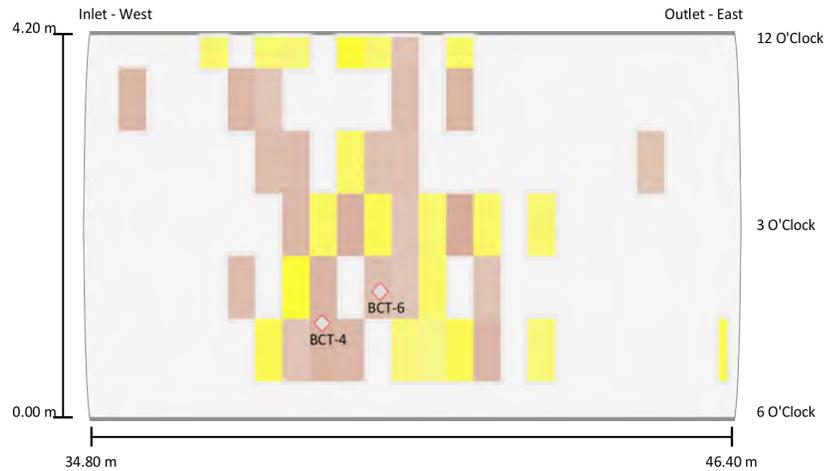
Acoustic Anomalies

X1	X2	Clock 1	Clock 2
No acoustic anomalies found.			

Insight™ BCT Images

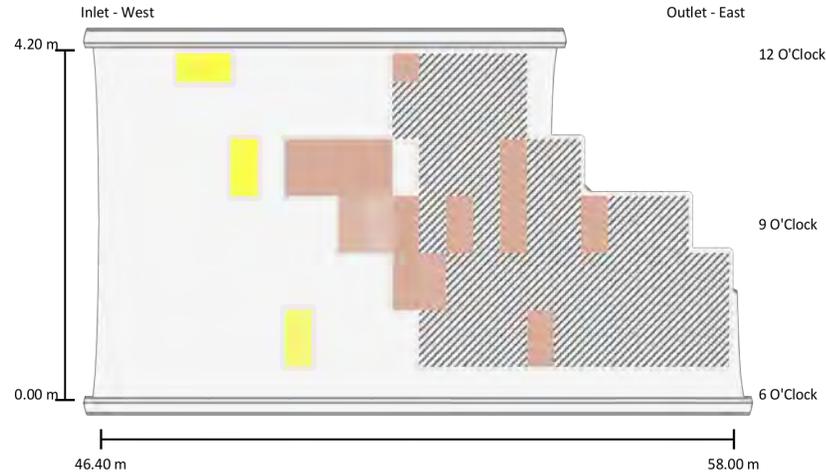
	X	Clock	Scan ID	Verdict
BCT-4	39.10 m	04:30	6470	Multiple voids, maximum size 50 mm x 25 mm.
BCT-5	40.00 m	07:30	6469	Multiple voids, maximum size 50 mm x 25 mm.
BCT-6	40.15 m	04:00	6468	Multiple voids, maximum size 40 mm x 40 mm.
BCT-7	42.30 m	07:30	6467	Multiple voids, maximum size 86 mm x 59 mm.

Segment 4 - Cobblers Brook Culvert - South - South Wall



- Visual Indicators
- ◆ InSight™ BCT Images
- Acoustic Anomalies
- InSight™ Lite Anomalies

Segment 5 - Cobblers Brook Culvert - South - North Wall



Visual Indicators

X1	X2	Clock 1	Clock 2	Comments
No visual indicators found.				

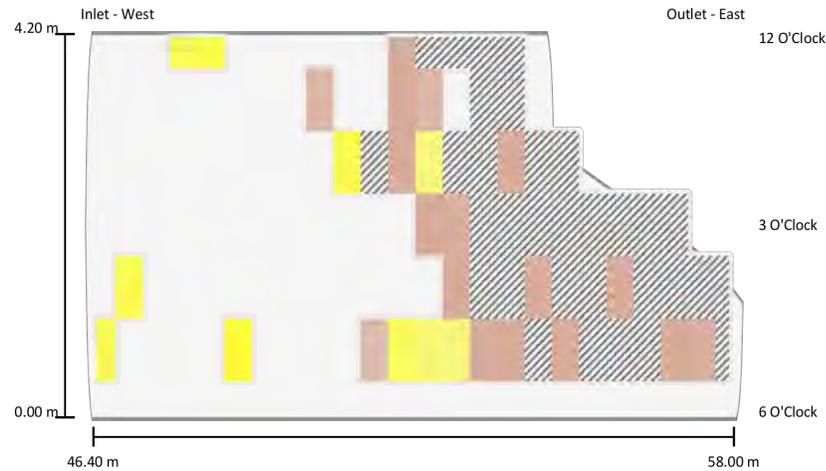
Acoustic Anomalies

X1	X2	Clock 1	Clock 2
No acoustic anomalies found.			

InSight™ BCT Images

X	Clock	Scan ID	Verdict
No BCT images included.			

Segment 5 - Cobblers Brook Culvert - South - South Wall

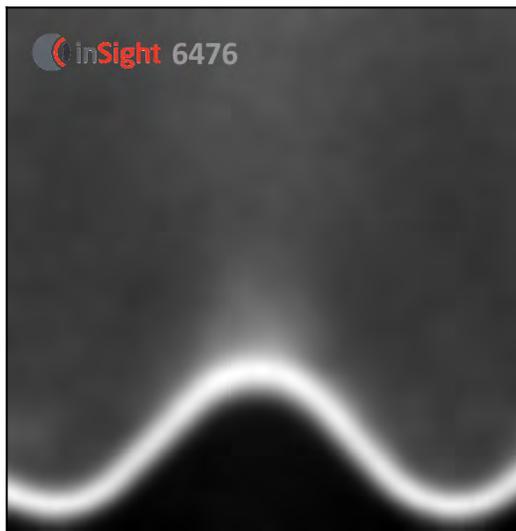


- [] Visual Indicators
- ◆ ◆ InSight™ BCT Images
- Acoustic Anomalies
- ▨ InSight™ Lite Anomalies

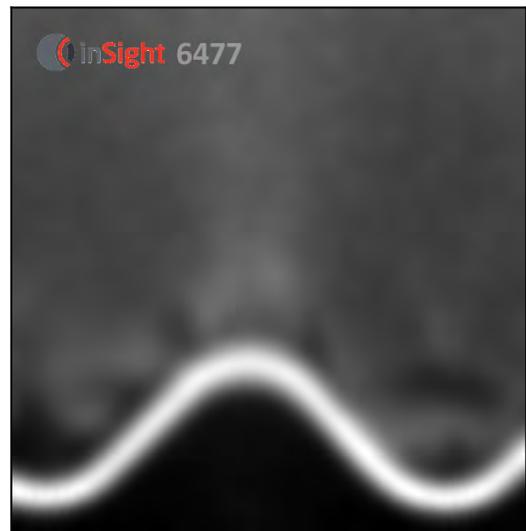
Areas for diagnostic Backscatter Computed Tomography (BCT) imaging were selected based on the results from the visual, acoustic and InSight™ Lite assessment. The BCT scanner was positioned against the pipe wall covering a region of 200 mm along the pipe wall, at each location, to verify supporting soil presence. The depth of the image is set to a target depth up to 225 mm from the scanners face.

BCT images provide a cross-sectional view of the pipe wall. The lower portion of the image indicates the front (accessible) side of the pipe wall. An increase in the Y direction indicates the depth behind the wall. The X axis is the range along the length of the pipe wall.

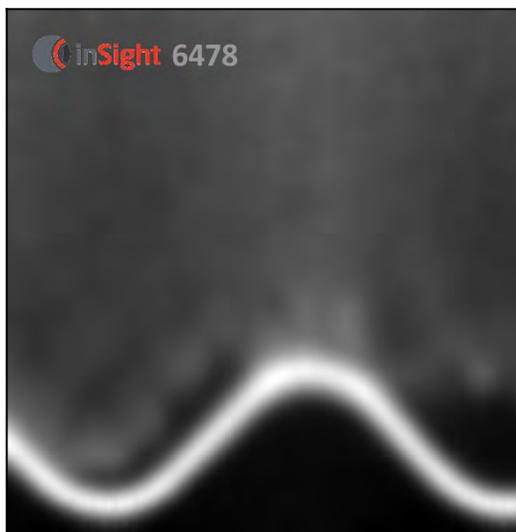
The following images are used to verify supporting soil condition and presence. The unique InSight™ scan ID corresponds to a scan location on the pipe map. Voids are only reported if they are greater than 10 mm².



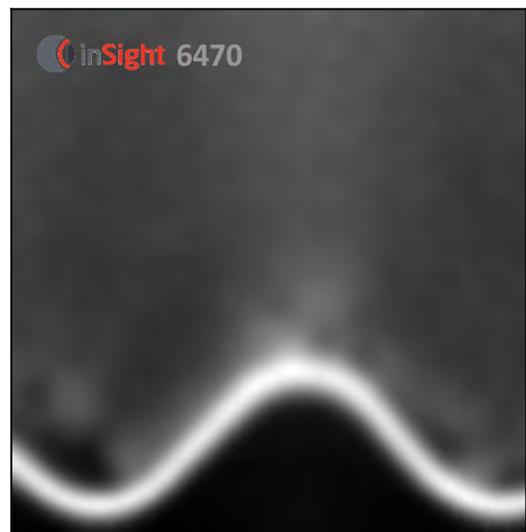
BCT-1 (Scan ID: 6476)
No void. Control point.



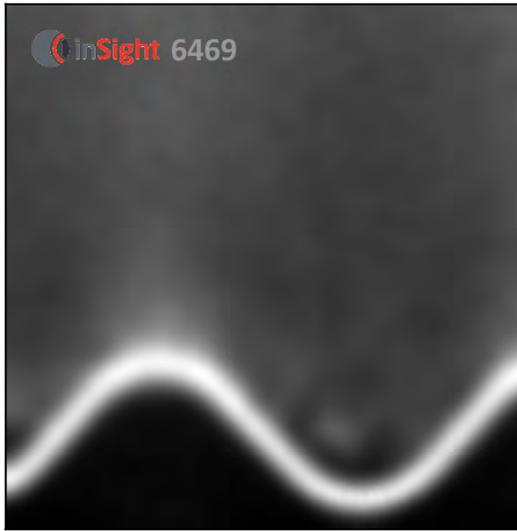
BCT-2 (Scan ID: 6477)
Multiple voids, maximum size 77 mm x 40 mm.



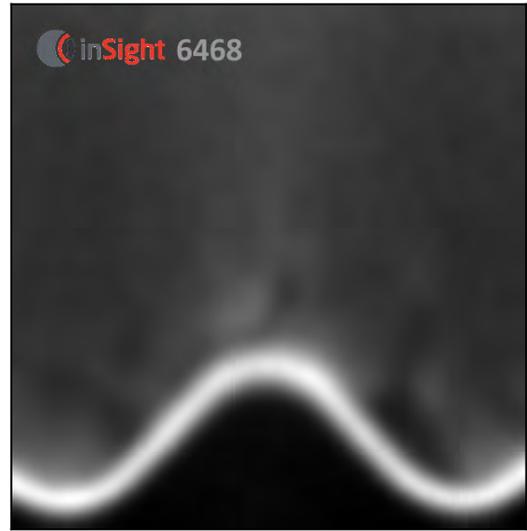
BCT-3 (Scan ID: 6478)
Multiple voids, maximum size 51 mm x 52 mm.



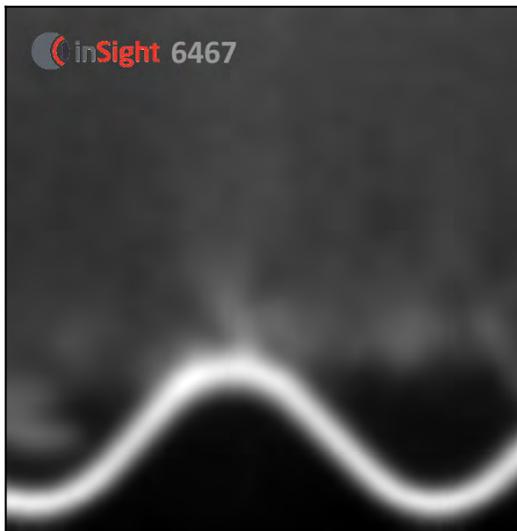
BCT-4 (Scan ID: 6470)
Multiple voids, maximum size 50 mm x 25 mm.



BCT-5 (Scan ID: 6469)
Multiple voids, maximum size 50 mm x 25 mm.



BCT-6 (Scan ID: 6468)
Multiple voids, maximum size 40 mm x 40 mm.



BCT-7 (Scan ID: 6467)
Multiple voids, maximum size 86 mm x 59 mm.

The visual appraisal assesses ten Components.

Each "Component" is ranked 1 through 5 with 1 being "excellent" and 5 being "high probability of failure". "Ranks" are based on measurable field observations for each "Component" evaluated and based on industry standards where available. "Comments" are provided based on visual field notes as applicable.

Pavement

Rank 1

Pavement in excellent condition.



Photo 2 - South approach has no horizontal curve and a slight downhill vertical grade.



Photo 1 - North approach has a medium left-hand curve with a slight downhill vertical grade.



Photo 3 - Route 1 facing north.



Photo 4 - Route 1 facing south.

Guardrail

Rank 2

Inlet guardrail.: Present.

Outlet guardrail.: Present.

- Broken, rotten, or damaged post(s) present.

Number of damaged posts.: 1



Photo 7 - Minor damage to post along the outlet guardrail.



Photo 6 - Outlet guardrail, facing south.



Photo 5 - Inlet guardrail, facing north.



Photo 8 - Inlet guardrail.



Photo 9 - Outlet guardrail.

Embankment

Rank 1

Embankment stable, no visible ruts or erosion channels. No large vegetation present.

Inlet Embankment

- Rip-Rap stabilizing embankment present.

Outlet Embankment

- Rip-Rap stabilizing embankment present.



Photo 11 - Outlet embankment, facing north.



Photo 10 - Inlet embankment, facing south.



Photo 12 - Inlet embankment.



Photo 13 - Outlet embankment.

Headwall

Rank N/A

Inlet Headwall: No headwall present.

Outlet Headwall: No headwall present.



Photo 15 - Outlet overview of both North and South pipes.



Photo 14 - Inlet overview of both North and South pipes.



Photo 16 - Inlet overview.



Photo 17 - Outlet overview.

Waterway Blockage

Rank 1

No waterway blockages found.

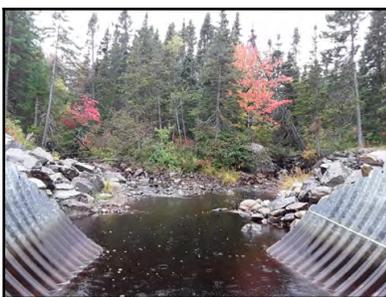


Photo 18 - Upstream channel view.

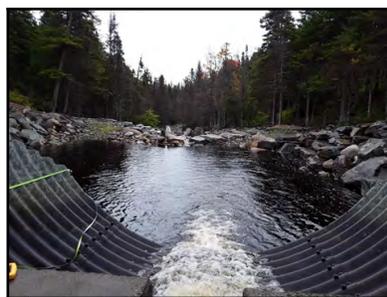


Photo 19 - Downstream channel view.

Scour

Rank 4

Outlet End

- Outfall is perched/elevated: **Severity:** Very Severe (> 300 mm (12 in) Height).
- Scour hole beneath pipe invert present: **Severity:** Very Severe (> 500 mm (20 in) Depth).



Photo 23 - Water pooling along the south side of the inlet pipe wall.



Photo 22 - Water pooling along the north side of the inlet pipe wall.



Photo 21 - Scouring measuring approximately 4100 mm in depth at the outlet.



Photo 20 - Pipe outlet is perched by approximately 700 mm in height.

Corrosion and Coatings

Rank 3

- Corrosion present: **Severity:** Corrosion causing pitting and wall loss present.



Photo 24 - Surface corrosion with areas of pitting and wall loss present throughout the invert.



Photo 25 - Pipe wall from 7:00 o'clock to 5:00 o'clock in overall in excellent condition.

Cracks, Seams, and Joints

Rank 3

- Water intrusion present.
- Water intrusion at seam(s) present.



Photo 26 - Typical level 1 water infiltration at bolts along the seams at the 5:00 o'clock position.



Photo 27 - Pipe has a total of 15 fish weirs installed.

Shape, Dents, and Localized Damage

Rank 2

Maximum shape deviation of approximately -1.7%.

- Dent(s) present on the pipe wall: **Severity:** Moderate (< 50 mm (2 in) Depth).



Photo 28 - Multiple small dents near the outlet, protruding up to approximately 40 mm.

Pipe Alignment

Rank 1

Pipe well aligned.



Photo 29 - Upstream pipe alignment and shape.



Photo 30 - Downstream pipe alignment and shape.

Shape deviation measurements are used to examine the structure's current deformation. Deformation may be caused by construction or deterioration. This information is intended to be used to trend future changes of pipe geometry indicating possible instability, unequal loading, or soil movement.

A horizontal and vertical measurement of the pipe's dimension is taken at even intervals along the pipe. A corresponding percentage difference from the expected horizontal and vertical design dimensions is also calculated.

The expected design diameter for Cobblers Brook Culvert - South is 4200 mm.

Distance from Inlet	Horizontal Diameter	Horizontal Deviation	Vertical Diameter	Vertical Deviation
5.00 m	4200 mm	0.0%	4200 mm	0.0%
10.00 m	4170 mm	-0.7%	4160 mm	-1.0%
20.00 m	4180 mm	-0.5%	4200 mm	0.0%
30.00 m	4190 mm	-0.2%	4200 mm	0.0%
40.00 m	4180 mm	-0.5%	4130 mm	-1.7%
52.00 m	4200 mm	0.0%	4130 mm	-1.7%

Note: Vertical deviation measurements may be missing due to sediment or debris build up.

Pertinent photos are included below to show site conditions and features of interest.



Photo 1 - North approach has a medium left-hand curve with a slight downhill vertical grade.



Photo 2 - South approach has no horizontal curve and a slight downhill vertical grade.



Photo 3 - Route 1 facing north.



Photo 4 - Route 1 facing south.



Photo 5 - Inlet guardrail, facing north.



Photo 6 - Outlet guardrail, facing south.



Photo 7 - Minor damage to post along the outlet guardrail.



Photo 8 - Inlet guardrail.



Photo 9 - Outlet guardrail.



Photo 10 - Inlet embankment, facing south.



Photo 11 - Outlet embankment, facing north.



Photo 12 - Inlet embankment.



Photo 13 - Outlet embankment.



Photo 14 - Inlet overview of both North and South pipes.



Photo 15 - Outlet overview of both North and South pipes.



Photo 16 - Inlet overview.



Photo 17 - Outlet overview.

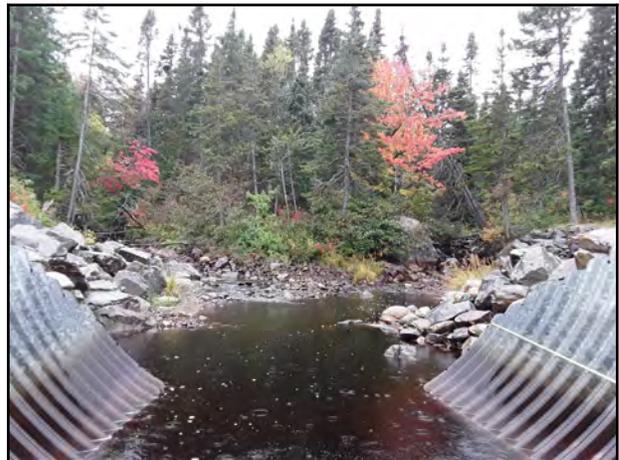


Photo 18 - Upstream channel view.



Photo 19 - Downstream channel view.



Photo 20 - Pipe outlet is perched by approximately 700 mm in height.



Photo 21 - Scouring measuring approximately 4100 mm in depth at the outlet.



Photo 22 - Water pooling along the north side of the inlet pipe wall.



Photo 23 - Water pooling along the south side of the inlet pipe wall.



Photo 24 - Surface corrosion with areas of pitting and wall loss present throughout the invert.



Photo 25 - Pipe wall from 7:00 o'clock to 5:00 o'clock in overall in excellent condition.



Photo 26 - Typical level 1 water infiltration at bolts along the seams at the 5:00 o'clock position.



Photo 27 - Pipe has a total of 15 fish weirs installed.



Photo 28 - Multiple small dents near the outlet, protruding up to approximately 40 mm.



Photo 29 - Upstream pipe alignment and shape.



Photo 30 - Downstream pipe alignment and shape.



Photo 31 - V-1: Level 3 water infiltration at seam.



Photo 32 - V-2: Level 3 water infiltration at bolt.



Photo 33 - V-3: Level 3 water infiltration at bolt.



Photo 34 - V-4: Level 2 water infiltration at seam.



Photo 35 - V-5: Level 3 water infiltration at seam.



Photo 36 - V-6: Level 3 water infiltration at bolt.



Photo 37 - V-7: Level 3 water infiltration at bolt.



Photo 38 - V-8: Level 2 water infiltration at bolt.



Photo 39 - V-9: Level 3 water infiltration at bolt and seam.



Photo 40 - V-10: Level 3 water infiltration at bolt.



Photo 41 - V-11: Level 3 water infiltration at bolt.



Photo 42 - Passing lane 2 km sign on the east embankment, located north from the asset.



Photo 43 - Centre lane yield sign on the east embankment, located south from the asset.



Photo 44 - Centre lane yield sign on the west embankment, located south from the asset.



Photo 45 - Right lane ends sign on the west embankment, located south from the asset.



Photo 46 - Centre lane yield sign on the east embankment, located south from the asset.



Photo 47 - Centre lane yield sign on the west embankment, located south from the asset.



Photo 48 - Water test results: water hardness 0 ppm, total alkalinity 40 ppm, and pH of 6.8.

The asset Cobblers Brook Culvert - South located on Route 1 in Census Division No. 7, consists of a multi-plate circular corrugated metal pipe (CMP) culvert with an approximate diameter of 4.20 m and length of 58.00 m. Visual inspections and inSight™ Lite assessment were performed at this site which found 11 visual indicators, and some inSight™ Lite anomalous regions inside the culvert. This resulted in seven (7) BCT images. The images found six (6) locations of soil voiding.

This pipe was part of a double pipe structure where two (2) parallel culverts were found at the same location. To provide unique identifiers for each pipe, they were labelled from north to south. Considering each pipe's proximity and interdependence, these asset's should be considered as a whole. It should be noted that the north pipe was constructed at a high elevation, and appears to serve as an animal crossing.

The culvert was found to be in fair condition and a few deficiencies were noted. The inlet was found to have water pooling behind the pipe wall, while the outlet was found to be perched approximately 700 mm in height with scour of approximately 4000 mm in depth. The inspection revealed eleven (11) visual indicators throughout the pipe. Ten (10) of the documented visual indicators consisted of level 2 to level 3 water infiltration at bolts and seams at the 5:00 o'clock position from 6.90 m to 19.30 m. V-3 noted level 3 water infiltration at the bolt along the seam at 10.50 m, at the 7:00 o'clock position.

The deviation from expected design shape varied through the pipe with a maximum horizontal deviation of -0.7%, 10.00 m from the inlet and a maximum vertical deviation of -1.7%, 40.00 m from the inlet.

An inSight™ Lite screening was performed at this site. The inSight™ Lite assessment identified areas of potential soil void around the culvert barrel resulting in seven (7) BCT scans. Due care was taken at the time of the BCT analysis to complete a hunt mode with the inSight™ Lite scanner within the anomalous regions to locate the most likely areas of void. Soil voiding was confirmed at BCT-2 through BCT-7. BCT-1 was a planned control point, and showed no soil voiding. The most significant void was identified at BCT-7, and measured approximately 86 mm x 59 mm. Each inSight™ BCT scan was located within an area of potential void identified by the inSight™ Lite assessment.

Based on the findings, the water infiltration at the bolts and seams is a sign of water flow behind the pipe wall. The pooling identified at the inlet has resulted in this infiltration, most significantly along the 5:00 o'clock position. Furthermore, the severe scour noted at the outlet, if not repaired in a timely manner, could result in end section and/or embankment failures.

It is therefore recommended that the following maintenance work is carried out within the next 6 to 12 months. The estimated cost of maintenance is \$60,000.00 excluding taxes. The maintenance cost estimation is assumed to be part of a larger contract work and not as a stand-alone asset activity. Maintenance duration is estimated at 7 to 10 days, and the general scope of work should include the following items:

- Install flow by-pass and de-water the pipe;
- Clean/Remove material buildup present within the culvert;
- Fill all voids identified by the BCT imaging with an appropriate grouting material (e.g. hydrophobic chemical, or cementitious grout);
- Fill visible void areas/scoured area with an appropriate grouting material (e.g. hydrophobic chemical, or cementitious grout); and
- Install erosion control measures (e.g. headwall, or riprap) at both ends of the culvert as per a design/method approved by a design engineer.

The captured BCT images shall be referenced prior to and during the grout injection process. The images are situated using the distance from the inlet, as well as the corresponding clock position. BCT scans should be used to help estimate the required grouting material volume.

Should any area of visible void or active water infiltration be revealed once the pipe has been de-watered/cleaned, or during the repair process, appropriate repairs shall be undertaken to remediate the identified deficiencies. Depending on the extent of deficiencies discovered following the cleaning process, additional expenses may be required to remediate the deficiencies.

Following the maintenance work, consideration should be given to completing a follow-up inSight™ Lite assessment in order to help ensure that the grout injections were successfully completed and to ensure that no other significant areas of potential soil void are present around the asset. It is also recommended that the asset continues to be monitored at its current inspection intervals. Subsequent inspections should emphasize monitoring the previously noted water infiltration areas to ensure that no additional maintenance work is required.

Given their proximity, and seeing as they form part of the same hydraulic system, consideration should be given to completing the prescribed maintenance work in conjunction with the prescribed work for assets Cobblers Brook Culvert - North.

SoilSight™ Condition Assessment

Parks Canada NL - 2021

Platter's Cove Culvert

Route 1 in Census Division No. 7

General Summary

The asset Platter's Cove Culvert located on Route 1 in Census Division No. 7, consists of a spiral wound circular corrugated metal pipe (CMP) culvert with a polymer coating. The asset is located at latitude 48° 25' 47.530" N, longitude 54° 6' 42.334" W. The dimensions of the asset were found to be approximately 3.60 m in diameter and 47.00 m in length. The asset has approximately 4.10 m of cover from the obvert to the road surface and flows generally north to south.

Inversa Systems performed an in depth condition assessment of this asset to aid in life cycle optimization.

Details of this work are contained within this report; a summary is as follows:

- 7 visual indicators were located
- InSight™ Lite anomalies were identified
- 4 voids were observed, 4 inSight™ BCT images were completed
- Outcome: Maintenance Recommended
- Estimated Cost of Maintenance: \$55,000.00 excluding taxes
- Recommended Completion: 6 to 12 months
- Estimated Maintenance Duration: 7 to 10 days

Asset ID	Platter's Cove Culvert
Location	Census Division No. 7
GPS	48° 25' 47.530" N, 54° 6' 42.334" W
Inspection Date	September 29, 2021
Written By	Colin Hansen, Field Tech.
Reviewed By	Dave Beckingham, Technologist.
Approved By	Jocelin Bourgeois, B.Sc.Eng., MBA



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Technical Explanation of Pipe Map Protocol

The entire culvert inspection is captured in the soilSight™ Pipe Map found in the following pages. It shows the asset in its entirety and displays the following collected data:

- Visual indicators
- Acoustic anomalies
- InSight™ BCT locations / results
- InSight™ Lite screening
- Water level
- Pipe dimensions

Sections within each asset that contain BCT image locations, inSight™ Lite screening, acoustic anomalies or visual indicators are displayed on a separate Segmented soilSight™ Pipe Map, which provides a more detailed view. The purpose of this level of detail is to define the exact location of all acoustic anomalies, visual indicators, inSight™ Lite locations, and BCT locations for future reference, deterioration trending, rehabilitation efforts and will allow detailed measurements to be used for maintenance, repairs or rehabilitation planning. The number of segments is at the discretion of the report writer and is based on the number of deficiencies discovered. If no repairs are required, measurements should be used to trend deterioration from one inspection cycle to another.

The X-coordinates are measured relative to the pipe inlet. The Y-coordinates are defined by a clock position with the invert being 6 o'clock, the obvert being 12 o'clock, the left springline being 9 o'clock and the right springline being 3 o'clock with the Inversa field inspector oriented facing downstream from the inlet to outlet (with the inlet at their back).

Acoustic Assessment

The purpose of the acoustic assessment or “knock test” is to determine possible locations (not severity) of suspected voids in the pipe's supporting soil and to aid in targeting and prioritization of anomaly imaging with BCT. A detailed knock test is performed at every second corrugation (approximately every 15-20 cm (6-8 in)) on both sides of the pipe, at five relative elevations: waterline, pipe springline, forty-five degrees above and below springline and obvert. Based on the acoustic and/or inSight™ Lite screening, the soilSight™ Pipe Map is generated to guide diagnostic imaging. Note: the terminal (unburied) ends of the pipe are considered transition zones and are not mapped unless voids are visible or extend beyond the transition zone.

Visual Inspection

The purpose of the visual inspection is to identify and locate deficiencies within the entire culvert structure. The visual inspection assesses ten (10) components of the structure, beginning from the road surface down through to the pipe barrel. Rankings are assigned a value between 1 and 5 for each component, based on pre-determined criteria. Inspector field notes are also recorded for each of the ten (10) components. Specific visual indicators are flaws found within the pipe barrel that have a location associated with them.

These visual anomalies are reflected in the soilSight™ Pipe Map in relation to the entire structure. Examples are separated joints, bolt-hole tears, through-wall corrosion, etc. ASTM C1870/C1840M shall be used to evaluate the infiltration of water inside the culvert. The levels of infiltration are as follows:

- Level 1 Infiltration - Moisture visible on the surface of the culvert
- Level 2 Infiltration - Slow entry of water identified by visible drips
- Level 3 Infiltration - Continuous stream of water running inside culvert

InSight™ BCT Images

BCT analysis is undertaken after the visual inspection, the acoustic and the inSight™ Lite screening only if warranted. Once an acoustic anomaly is identified, a more thorough “knock test” is performed within the anomaly to find the precise location for BCT deployment. Typically, BCT scans are captured within the acoustic anomalies and/or inSight™ Lite regions. Visual indicators can also dictate scan locations if they demonstrate evidence of soil loss in a specific area. Once all scans are captured for an asset, they are uploaded to the InSight™ portal service where the images are processed, and voids are quantified.

InSight™ Lite Screening

The purpose of the inSight™ Lite screening is to identify areas of potential low soil density / void behind the culvert wall. Once anomalous areas are identified through the inSight™ Lite screening, the asset owner can then validate and quantify these regions through inSight™ BCT imaging.

A detailed soil density measurement is collected every 0.5 m to 1.0 m (20 to 40 in) increment inside the pipe wall, taken every available clock position. Once all inSight™ Lite measurements are captured, they are uploaded to the soilSight™ portal where the measurements are processed, and potential anomalous locations are identified within the pipe map. The regions are categorized based on their probability to contain voids, from low probability being yellow to high probability being brown.

Regardless of whether inSight™ BCT imaging was completed, inSight™ Lite data sets should be used on subsequent inspections to trend soil density changes and aid in prioritization of which assets warrant further assessment, ultimately leading towards a more comprehensive asset management program.

Visual Appraisal Results

Following the inSight™ BCT Validation Results section (if applicable) is the Visual Appraisal Results, where ten components of the structure are ranked between 1 and 5. Each rank, for each component, has a precise definition associated with it, based on best practices and industry standards. The criteria are defined in Inversa’s soilSight™ Standard Operating Procedure (SOP), available upon request.

Each 1 to 5 ranking has an associated condition description, used for reporting purposes, as follows:

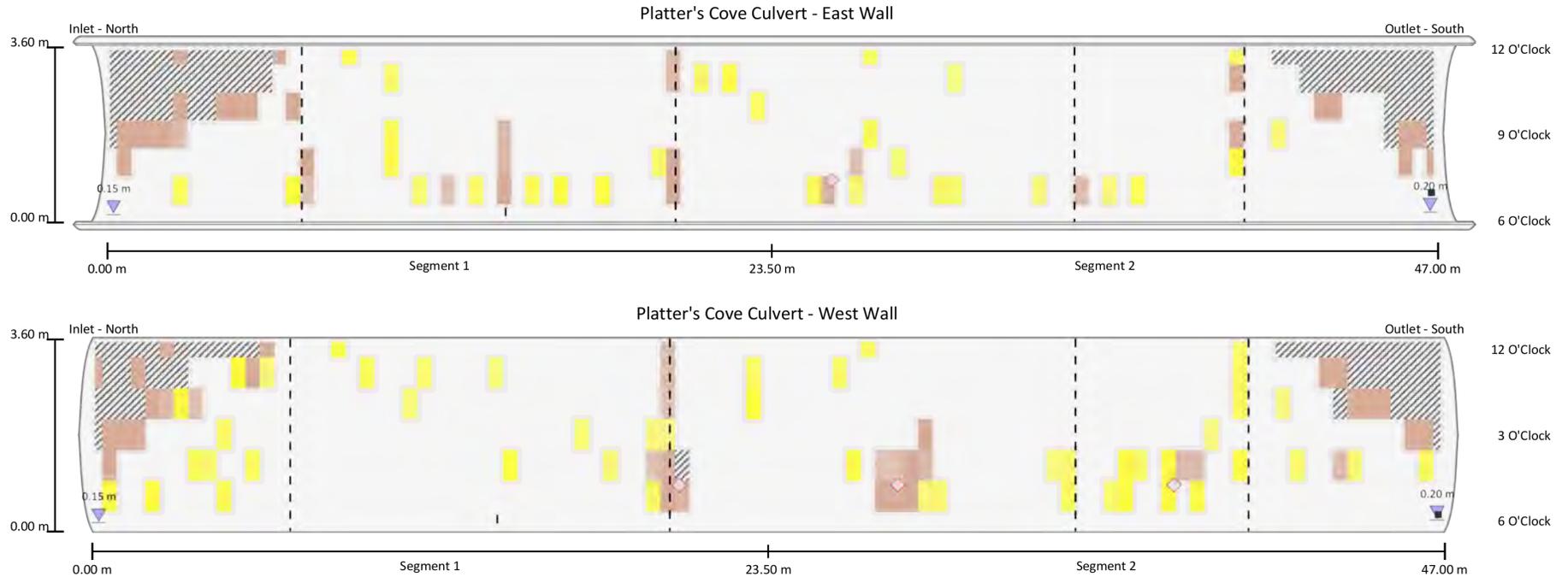
- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)
- High Probability of Failure (5)

Shape Deviation

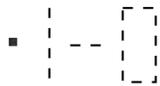
Horizontal and vertical measurements are taken in the field at even intervals along the culvert. This information is used to trend future changes of pipe geometry indicating possible instability, unequal loading, or soil movement. A corresponding percentage difference from expected horizontal and vertical dimensions are provided in the Shape Deviation table.

Conclusion and Recommendations

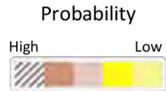
Conclusion and Recommendations are provided with any potential maintenance and/or rehabilitation recommendations including any estimated maintenance costs. The focus of the conclusion is mainly limited to components with a ranking of 3 or above unless specific concerns need to be addressed. If a detailed rehabilitation plan is warranted, a separate Asset Rehabilitation Plan is provided.



Acoustic Anomalies are designated as rectangles and are assigned an ID number. The X and Y position is recorded and displayed in the table for the corresponding pipe segment.



Visual Indicators are shown as black squares (isolated defects), dashed lines (linear defects) or rectangles with dashed lines (defects with a surface area), depending on the flaw type, and assigned a corresponding ID number. The X and Y position is recorded and displayed in the table for the corresponding pipe segment. Photos are included in the visual assessment section.



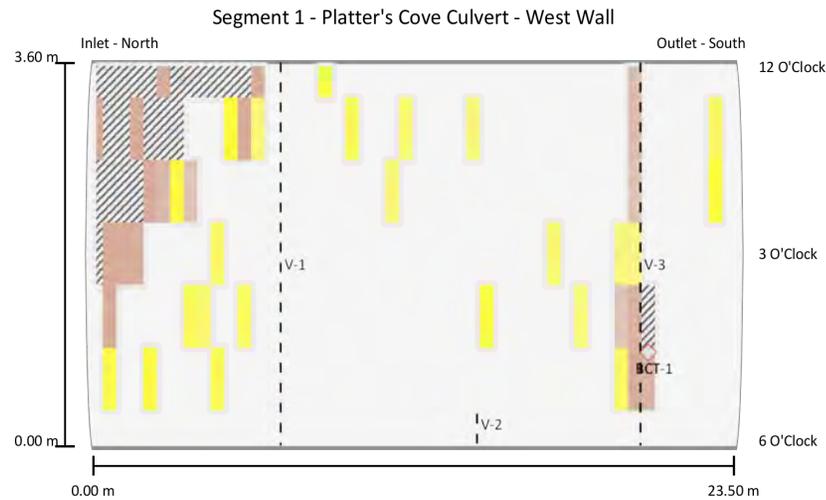
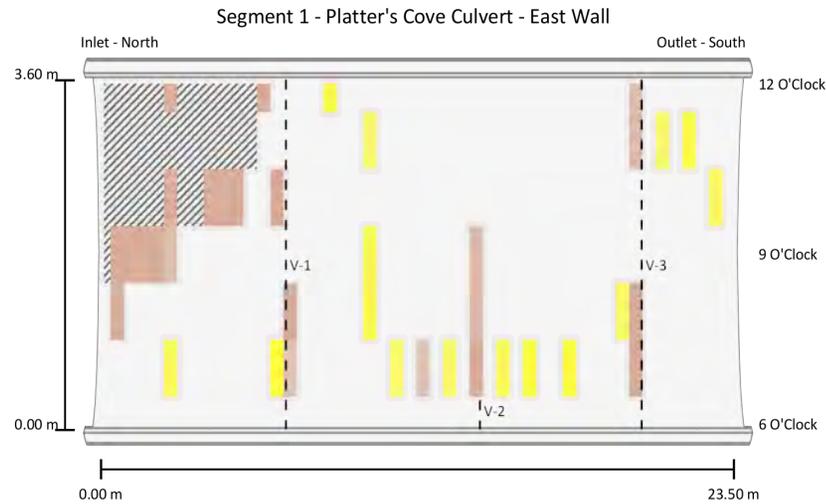
InSight™ Lite Anomalies are regions detected by the InSight™ Lite scanner which may contain voids or other low density material. The regions are categorized in terms of their probability to contain actual soil voids, from low probability being yellow to high probability being brown. The unburied ends of the culvert are represented as rectangles with black hash marks.



InSight™ BCT Images are assigned an ID number and are represented as red diamonds. Once a scan is captured, it is verified as void or solid backfill. The X and Y position is recorded and displayed in the table for the corresponding pipe segment.



Waterline Marks indicate the level of water in the pipe at the time of inspection.



- Visual Indicators
- ◆ InSight™ BCT Images
- Acoustic Anomalies
- ▨ InSight™ Lite Anomalies

Visual Indicators

	X1	X2	Clock 1	Clock 2	Comments
V-1	6.90 m	6.90 m	-	-	Offset joint by approximately 40 mm with a visible coupler.
V-2	14.10 m	14.10 m	05:30	06:30	Offset joint by approximately 50 mm.
V-3	20.10 m	20.10 m	-	-	Offset joint by approximately 30 mm with a visible coupler and level 3 water infiltration evident.

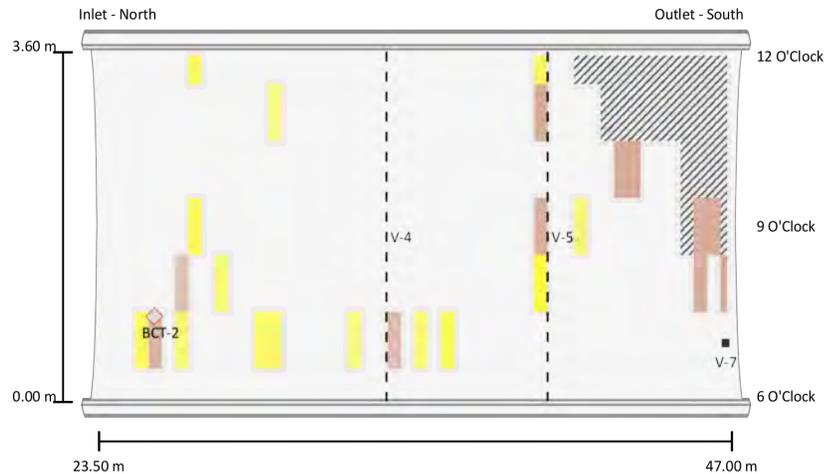
Acoustic Anomalies

X1	X2	Clock 1	Clock 2
No acoustic anomalies found.			

InSight™ BCT Images

X	Clock	Scan ID	Verdict	
BCT-1	20.60 m	04:30	6471	Multiple voids, maximum size 90 mm x 65 mm.

Segment 2 - Platter's Cove Culvert - East Wall



Visual Indicators

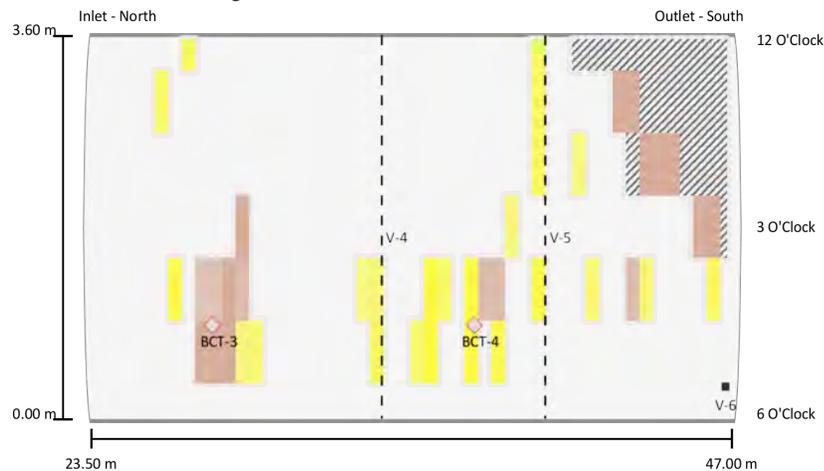
	X1	X2	Clock 1	Clock 2	Comments
V-4	34.20 m	34.20 m	-	-	Separated and offset joint by approximately 60 mm with a visible coupler.
V-5	40.20 m	40.20 m	-	-	Offset joint by approximately 50 mm with a visible coupler.
V-6	46.80 m	-	05:30	-	Level 3 water infiltration at bolts.
V-7	46.80 m	-	07:00	-	Level 3 water infiltration at bolt with organic matter buildup.

Acoustic Anomalies

X1	X2	Clock 1	Clock 2
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No acoustic anomalies found.

Segment 2 - Platter's Cove Culvert - West Wall



InSight™ BCT Images

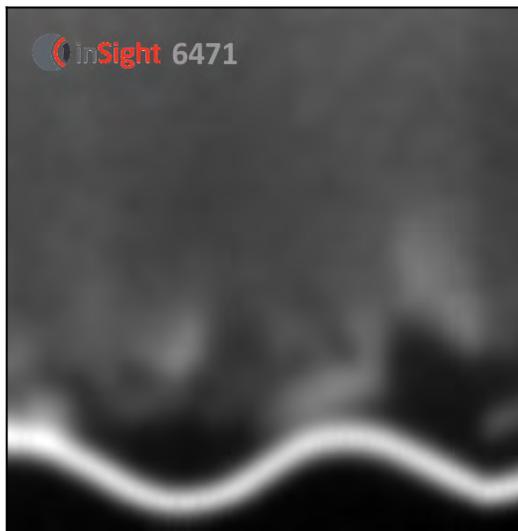
	X	Clock	Scan ID	Verdict
BCT-2	25.80 m	07:30	6472	200 mm x 65 mm void.
BCT-3	28.20 m	04:30	6473	200 mm x 178 mm void.
BCT-4	37.80 m	04:30	6474	Multiple voids, maximum size 90 mm x 72 mm.

- □ Visual Indicators
- ◆ ◆ InSight™ BCT Images
- Acoustic Anomalies
- ▨ InSight™ Lite Anomalies

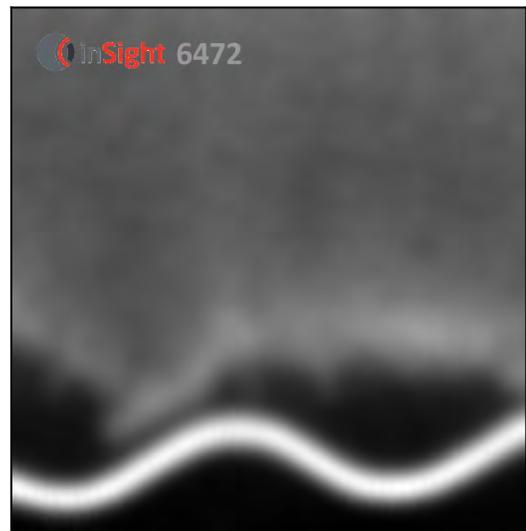
Areas for diagnostic Backscatter Computed Tomography (BCT) imaging were selected based on the results from the visual, acoustic and InSight™ Lite assessment. The BCT scanner was positioned against the pipe wall covering a region of 200 mm along the pipe wall, at each location, to verify supporting soil presence. The depth of the image is set to a target depth up to 225 mm from the scanners face.

BCT images provide a cross-sectional view of the pipe wall. The lower portion of the image indicates the front (accessible) side of the pipe wall. An increase in the Y direction indicates the depth behind the wall. The X axis is the range along the length of the pipe wall.

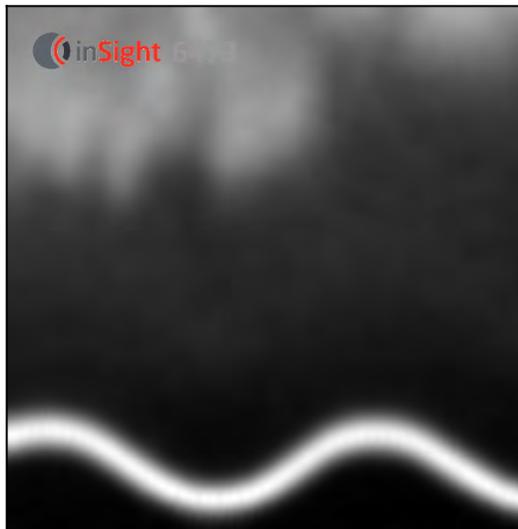
The following images are used to verify supporting soil condition and presence. The unique InSight™ scan ID corresponds to a scan location on the pipe map. Voids are only reported if they are greater than 10 mm².



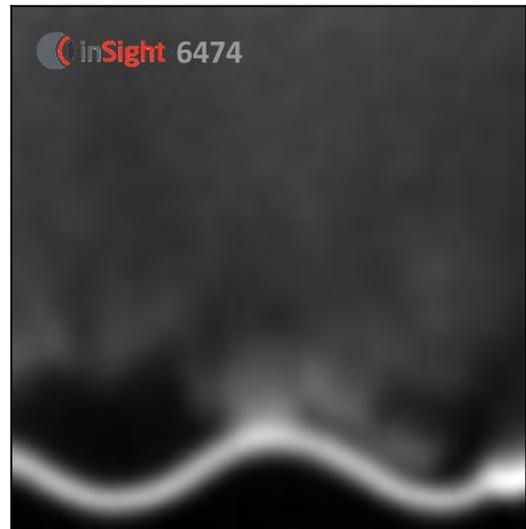
BCT-1 (Scan ID: 6471)
Multiple voids, maximum size 90 mm x 65 mm.



BCT-2 (Scan ID: 6472)
200 mm x 65 mm void.



BCT-3 (Scan ID: 6473)
200 mm x 178 mm void.



BCT-4 (Scan ID: 6474)
Multiple voids, maximum size 90 mm x 72 mm.

The visual appraisal assesses ten Components.

Each "Component" is ranked 1 through 5 with 1 being "excellent" and 5 being "high probability of failure". "Ranks" are based on measurable field observations for each "Component" evaluated and based on industry standards where available. "Comments" are provided based on visual field notes as applicable.

Pavement

Rank 1

Pavement in excellent condition.



Photo 2 - East approach has a moderate downhill vertical grade with a left-hand horizontal curve.



Photo 1 - West approach has a moderate downhill vertical grade with a long right-hand horizontal curve.



Photo 3 - Route 1 facing east.



Photo 4 - Route 1 facing west.

Guardrail

Rank 1

Guardrail in near new condition. No corrosion or missing components. No damage present. Location as designed. Structure well aligned both horizontally and vertically.

Inlet guardrail.: Present.

Outlet guardrail.: Present.



Photo 5 - Outlet guardrail.



Photo 6 - Inlet guardrail.



Photo 7 - Outlet guardrail.

Embankment

Rank 1

Embankment stable, no visible ruts or erosion channels. No large vegetation present.

Inlet Embankment

- Rip-Rap stabilizing embankment present.

Outlet Embankment

- Rip-Rap stabilizing embankment present.



Photo 8 - Outlet embankment, facing downstream.



Photo 9 - Inlet embankment, facing upstream.



Photo 10 - Inlet embankment.



Photo 11 - Outlet embankment.

Headwall

Rank 3

Waterflow between the pipe and the headwall, documented at the outlet.

Inlet Headwall: Concrete Headwall.

- Spalled area(s) present: **Frequency:** 2 - 5; **Severity:** Moderate (150 - 300 mm Length).

Outlet Headwall: Concrete Headwall.



Photo 15 - Minor spalling along the inlet headwall.



Photo 14 - Active water flowing between pipe wall and outlet headwall, with a separation of approximately 40 mm.



Photo 13 - Active water flowing between pipe wall and outlet headwall, with a separation of approximately 40 mm.



Photo 12 - Active water flowing between headwall and pipe wall at the outlet.



Photo 16 - Inlet overview.



Photo 17 - Outlet overview.

Waterway Blockage

Rank 1

No waterway blockages found.



Photo 18 - Typical water flow between fish weirs and pipe wall.



Photo 19 - Upstream channel view.



Photo 20 - Downstream channel view.

Scour

Rank 2



Photo 21 - Water pooling along the outlet concrete headwall.

Corrosion and Coatings

Rank 1

No corrosion or rust evident on the pipe wall, no damage or discoloration of the coating.

Cracks, Seams, and Joints

Rank 3

- Joint offset(s) present: **Severity:** Light (< 100 mm (4 in) Width).
 - Coupling device visible through joint offset(s).
- Joint separation(s) present: **Severity:** Light (< 100 mm (4 in) Width).
 - Coupling device visible through joint separation(s).
- Water intrusion present.

Shape, Dents, and Localized Damage

Rank 2

Maximum shape deviation of approximately -1.9%.

- Dent(s) present on the pipe wall: **Severity:** Moderate (< 50 mm (2 in) Depth).



Photo 22 - Small dent near the inlet, measuring approximately 30 mm in depth.

Pipe Alignment

Rank 1

Pipe well aligned.



Photo 23 - Upstream pipe alignment and shape.



Photo 24 - Downstream pipe alignment and shape.

Shape deviation measurements are used to examine the structure's current deformation. Deformation may be caused by construction or deterioration. This information is intended to be used to trend future changes of pipe geometry indicating possible instability, unequal loading, or soil movement.

A horizontal and vertical measurement of the pipe's dimension is taken at even intervals along the pipe. A corresponding percentage difference from the expected horizontal and vertical design dimensions is also calculated.

The expected design diameter for Platter's Cove Culvert is 3600 mm.

Distance from Inlet	Horizontal Diameter	Horizontal Deviation	Vertical Diameter	Vertical Deviation
0.00 m	3550 mm	-1.4%	3550 mm	-1.4%
10.00 m	3570 mm	-0.8%	3630 mm	0.8%
20.00 m	3610 mm	0.3%	3570 mm	-0.8%
30.00 m	3590 mm	-0.3%	3530 mm	-1.9%
40.00 m	3570 mm	-0.8%	3580 mm	-0.6%
47.00 m	3600 mm	0.0%	3600 mm	0.0%

Note: Vertical deviation measurements may be missing due to sediment or debris build up.

Pertinent photos are included below to show site conditions and features of interest.



Photo 1 - West approach has a moderate downhill vertical grade with a long right-hand horizontal curve.



Photo 2 - East approach has a moderate downhill vertical grade with a left-hand horizontal curve.



Photo 3 - Route 1 facing east.



Photo 4 - Route 1 facing west.



Photo 5 - Outlet guardrail.



Photo 6 - Inlet guardrail.



Photo 7 - Outlet guardrail.



Photo 8 - Outlet embankment, facing downstream.



Photo 9 - Inlet embankment, facing upstream.



Photo 10 - Inlet embankment.



Photo 11 - Outlet embankment.



Photo 12 - Active water flowing between headwall and pipe wall at the outlet.



Photo 13 - Active water flowing between pipe wall and outlet headwall, with a separation of approximately 40 mm.



Photo 14 - Active water flowing between pipe wall and outlet headwall, with a separation of approximately 40 mm.



Photo 15 - Minor spalling along the inlet headwall.



Photo 16 - Inlet overview.



Photo 17 - Outlet overview.



Photo 18 - Typical water flow between fish weirs and pipe wall.



Photo 19 - Upstream channel view.



Photo 20 - Downstream channel view.



Photo 21 - Water pooling along the outlet concrete headwall.



Photo 22 - Small dent near the inlet, measuring approximately 30 mm in depth.



Photo 23 - Upstream pipe alignment and shape.



Photo 24 - Downstream pipe alignment and shape.



Photo 25 - V-1: Offset joint by approximately 40 mm with a visible coupler.



Photo 26 - V-1: Offset joint by approximately 40 mm with a visible coupler.

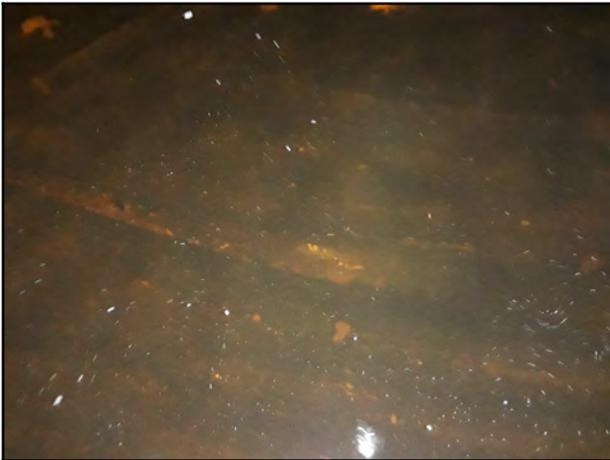


Photo 27 - V-2: Offset joint by approximately 50 mm.



Photo 28 - V-3: Offset joint by approximately 30 mm with a visible coupler and level 3 water infiltration evident.



Photo 29 - V-3: Offset joint by approximately 30 mm with a visible coupler and level 3 water infiltration evident.



Photo 30 - V-4: Separated and offset joint by approximately 60 mm with a visible coupler.



Photo 31 - V-4: Separated and offset joint by approximately 60 mm with a visible coupler.



Photo 32 - V-5: Offset joint by approximately 50 mm with a visible coupler.



Photo 33 - V-5: Offset joint by approximately 50 mm with a visible coupler.



Photo 34 - V-6: Level 3 water infiltration at bolts.

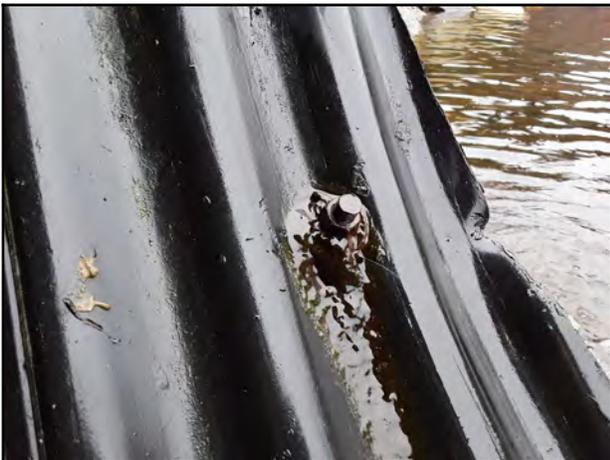


Photo 35 - V-7: Level 3 water infiltration at bolt with organic matter buildup.



Photo 36 - Keep right except to pass sign on the outlet (north) embankment.



Photo 37 - Sharp left turn sign on east side of the roadway, on the northbound approach lane.



Photo 38 - Keep right except to pass sign on the inlet embankment.



Photo 39 - Water test results: water hardness 0 ppm, total bromine 0 ppm, total alkalinity 0 ppm, and pH of 6.8.



Photo 40 - Pipe had a total of 9 fish weirs placed approximately 5.00 m apart.



Photo 41 - Slippery road sign on east side of the roadway, on the northbound approach lane.

The asset Platter's Cove Culvert located on Route 1 in Census Division No. 7, consists of a spiral wound circular corrugated metal pipe (CMP) culvert with a polymer coating, an approximate diameter of 3.60 m, and a length of 47.00 m. Visual inspections and inSight™ Lite assessment were performed at this site which found seven (7) visual indicators, and some inSight™ Lite anomalous regions inside the culvert. This resulted in four (4) BCT images. The images found four (4) locations of soil voiding.

The culvert was found to be overall in fair condition with some deficiencies noted. The inlet headwall was found to be in fair condition with minor spalling. The outlet headwall displayed level 3 water infiltration from the exterior pipe wall, as well as a separation of approximately 40 mm between the east side of the pipe, and the headwall, as seen in Photo 13. The inspection revealed seven (7) visual indicators throughout the pipe. V-1 through V-5 identified offset joints with visible couplers measuring between 30 mm to 60 mm in size. Joint V-3, at 20.10 m, also displayed level 3 water infiltration along the haunches. V-6 and V-7 documented level 3 water infiltration at bolts along the haunches near the outlet.

The deviation from expected design shape varied through the pipe with a maximum horizontal deviation of -1.4%, 0.00 m from the inlet and a maximum vertical deviation of -1.9%, 30.00 m from the inlet.

An inSight™ Lite screening was performed at this site. The inSight™ Lite assessment identified areas of potential soil loss within the culvert barrel resulting in four (4) BCT scans. Due care was taken at the time of the BCT analysis to complete a hunt mode with the inSight™ Lite scanner within the anomalous regions to locate the most likely areas of void. Soil voiding was confirmed at BCT-1 through BCT-4. The void sizes varied from 90 mm x 65 mm to 200 mm x 178 mm. Each inSight™ BCT scan was located within an area of potential soil loss identified by the inSight™ Lite assessment.

Based on the findings, it is evident that the asset's soil envelop is no longer in tact. The confirmed voids identified by the BCT imaging, if not remediated in a timely manner, could continuously increase in size, and place the asset at risk of potential failures due to un-even loading, and potential soil movement. Furthermore, the identified deficient joints, if left un-repaired, could lead to further water infiltration and/or soil loss, which would increase the rate of soil voiding around the asset. Similarly, the separated headwall at the outlet could worsen and lead to scouring/undermining, as well as potential embankment/end section failures.

It is therefore recommended that the following maintenance work is carried out within the next 6 to 12 months. The estimated cost of maintenance is \$55,000.00 excluding taxes. The maintenance cost estimation is assumed to be part of a larger contract work and not as a stand-alone asset activity. Maintenance duration is estimated at 7 to 10 days, and the general scope of work should include the following items:

- Install flow by-pass;
- Dewater within the pipe;
- Clean/Remove material buildup present within the culvert;
- Repair deficient joints V-1 through V-5 with an appropriate method approved by a design engineer (e.g. hydraulic mortar cement or mechanical coupler);
- Repair the outlet headwall with an appropriate method approved by a design engineer (e.g. fill visible voids with an appropriate grouting material, and finish to match pipe wall shape); and
- Fill all identified voids with an appropriate grouting material (e.g. hydrophobic chemical, or cementitious grouts).

The captured BCT images shall be referenced prior to and during the grout injection process. The images are situated using the distance from the inlet, as well as the corresponding clock position. BCT scans should be used to help estimate the required grouting material volume.

Should any area of visible void or active water infiltration be revealed once the pipe has been de-watered/cleaned, or during the repair process, appropriate repairs shall be undertaken to remediate the identified deficiencies. Depending on the extent of deficiencies discovered following the cleaning process, additional expenses may be required to remediate the deficiencies.

Following the maintenance work, consideration should be given to completing a follow-up inSight™ Lite assessment in order to help ensure that the grout injections were successfully completed and to ensure that no other significant areas of potential soil void are present around the asset. It is also recommended that the asset continues to be monitored at its current inspection intervals. Subsequent inspections should emphasize monitoring the previously noted water infiltration areas (bolts, joints, and headwalls) to ensure that no additional maintenance work is required.